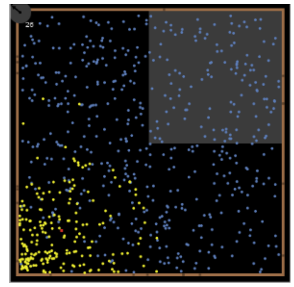
Name:____________________ *What have you learned today?* Unit 1 notes

Title:	Effect of Random Molecular Motion on Gas Properties
Standard:	*1.a I know the random motions of molecules and their collisions with a surface create the observable pressure on that surface and that the random motion of molecules explains the diffusion of gasses.*

1. Why does a fart diffuse through the air around it? Diagram this process.

The fart and air particles are in random molecular motion. The random molecular motion of the fart particles will eventually cause them to spread out into the room, although the air particles do get in the way.

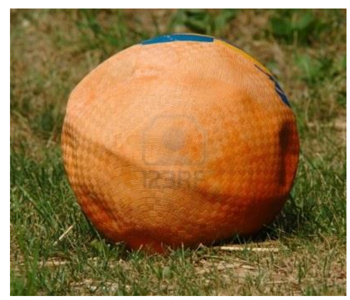


2. Putting a can of compressed air in a fire is a bad idea because it could explode. Explain in detail what happens that would cause the can to explode. Use as much vocab as possible.

The heat from the fire would increase the kinetic energy of the particles in the can. This would speed the particles up and increase the number of collisions. The pressure would increase and there is a possibility that the can could explode.

3. When a gas-filled ball is cooled overnight in Michigan in the winter, it shrinks considerably in volume. Once the sun comes up, the ball slowly begins to inflate to its original size. Explain.

The sun's light rays will increase the temperature in the balloon, causing the particles to move faster. They will hit the sides of the wall more often, which will push the balloon out, causing the volume to increase to its original size.



4. Why do fighter jet pilots need oxygen masks even though they are still in the earth's atmosphere?

High up in the atmosphere, there is less atmospheric pressure. This causes the particles of oxygen to be farther away from each other. Since there are less oxygen molecules, the pilots have to bring their own oxygen to be able to breathe easily.

Name:_____________________ *What have you learned today?* Unit 1 notes

Title:	The Combined Gas Law
Standard:	*1.b I can apply the gas laws to relations between the pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases.*

1. Are pressure and volume inversely or proportionally related? Explain in terms of collisions.

Pressure and volume are inversely proportional. As volume increase, pressure decreases, and vice versa. If the volume increases, there is more room for particles to move, making less collisions, and so the pressure goes down. If the volume decreases, there is less room, forcing the particles closer together and increasing the number of collisions and pressure.

2. At constant volume, the initial pressure of a substance is 0.63 atm and the initial temperature is 283K. Calculate the pressure of the substance at 295K.

$P_1 = 0.63atm$ $P_2 = ?$ $\frac{P_1}{T_1} = \frac{P_2}{T_2}$ $\frac{0.63atm}{283K} = \frac{P_2}{295K}$

$T_1 = 283K$ $T_2 = 295K$

$$\frac{0.63\ atm\ x\ 295K}{283K} = P_2 = 0.66\ atm$$

The pressure at 295K would be 0.66atm.

3. A sample of gas has a volume of 50.0L at a temperature of 300.0K. At what temperature must the gas be to have a volume of 60.0L if its pressure remains constant?

$V_1 = 50L$ $T_1 = 300K$ $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ $\frac{50L}{300K} = \frac{60L}{T_2}$

$V_2 = 60L$ $T_2 = ?$

$$\frac{T_2\ x\ 50L}{50\ L} = \frac{60L\ x\ 300K}{50\ L}$$

$T_2 = 360K$

The temperature would have to be heated to 360K.

4. An expandable container of dry air is cooled from 27°C to 7°C. If it had a volume of 5L at 2atm, what is the volume at 5atm?

$T_1 = 300K$ $T_2 = 280K$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\frac{2\ atm\ x\ 5L}{300K} = \frac{5\ atm\ x\ V_2}{280K}$

$V_1 = 5L$ $V_2 = ?$

$P_1 = 2atm$ $P_2 = 5atm$

$$\frac{2\ \cancel{atm}\ x\ 5L\ x\ 280\cancel{K}}{300\cancel{K}\ x\ 5\cancel{atm}} = V_2 = 1.87L$$

The final volume will be 1.87L

5. *Pressure vs. Volume* – Car engines contain pistons (small chambers of gas) that are compressed and decompressed while the engine functions. Predict the pressure inside the piston as the engine drives the car forward.

Situation	***Volume (V)***	***Pressure (P)***
Compressed fully while the engine is running.	15 mL	*4 atm*
Moving while the engine is running.	30 mL	*2 atm*
Resting while the engine is off.	60 mL	Standard Pressure = *1* atm
At its most open position while the engine is running.	120 mL	*0.5 atm*
Pulled out to its maximum volume for an engine check.	240 mL	*0.25 atm*

Name:____________________ *What have you learned today?* Unit 1 notes

Title:	Standard Temperature and Pressure
Standard:	*1.c I can apply the values and meanings of standard temperature and pressure.*

1. What is standard temperature and pressure?

Standard temperature and pressure are internationally agreed upon values for what a normal temperature/pressure is. T = 273K or 0^{o}C. P = 1 atm = 760 torr = 760 mmHg.

2. At STP, how much space will 4.5 moles of gas take up?

$$\frac{4.5\ mol}{}\ x\ \frac{22.4L}{1\ mol} = 100.8L$$

4.5mol of gas will take up 100.8L at STP.

3. At 760torr and 273K, how many molecules will occupy 22.4L? Explain or show work.

This is STP. So since the molar volume at STP is 22.4L, that is just one mole.

4. Can you use the equality, 1mol = 22.4L, when not at STP? Why or why not?

No you cannot. The molar volume changes based on the temperature and pressure. For example, higher temperatures will make 1 mole of gas take up more than 22.4L.

Name:____________________ *What have you learned today?* Unit 1 notes

Title:	Temperature Scales
Standard:	*1.d I can convert between the Celsius and Kelvin temperature scales and that there is no temperature lower than 0 Kelvin.*

1. What is absolute zero? Why is it called absolute?

Absolute zero is the temperature at which you have no energy. It is called absolute because it is the lowest temperature possible.

2. What is the difference between the Celsius and Kelvin temperature scales?

The Celsius scale is relative to water and 0^oC is based on the freezing point of water. The Kelvin scale is based on absolute zero. 0K is the lowest temperature possible and is known as absolute zero.

3. Can the Kelvin scale ever go below zero? Why or why not?

No it cannot. At 0K, you are at absolute zero. That is the lowest temperature possible.

4. Convert the following temperatures from degrees Celsius to Kelvin.
   a. 0^oC *+ 273 = 273K*
   b. -230^oC *+ 273 = 43K*
   c. 193^oC *+ 273=466K*

5. Convert the following temperatures from Kelvin to degrees Celsius.
   a. 0K *-273 = -273^oC*
   b. 157K *-273 = -116^oC*
   c. 300K *-273 = 27^oC*

6. How is temperature manifested on the molecular level?

Temperature is related to the kinetic energy of molecules, which in turn relates to how fast the particles move.

7. Why can't you use Celsius in the combined gas law or ideal gas law equations?

Celsius is a relative scale. You must use an absolute temperature scale so that the numbers scale properly.

Name:____________________ *What have you learned today?* Unit 1 notes

Title:	The Ideal Gas Law
Standard:	*1.e I can solve problems by using the ideal gas law in the form PV=nRT.*

1) According to the ideal gas law, at what temperature must a 0.42-mol sample of oxygen gas be to occupy a 500-ml container at 5.0atm?

n = 0.42mol *PV = nrT* *5atm x 0.5L = 0.42mol x 0.0821*$\frac{atm\ L}{mol\ K}$ *x T*

V = 500ml = 0.5L

P = 5.0atm *T =* $\frac{5\ x\ 0.5\ x\ K}{0.42\ x\ 0.0821}$ *= 72.5K*

T = ?

R = 0.0821 atmL/mol K *The temperature must be 72.5K- that is really cold!*

2) Tyler is inflating a balloon. She can generate 1.5atm of pressure at 300K. If she inflates the balloon to 3L, how many moles of gas are there?

P = 1.5 atm *T = 300K* *V = 3L* *n = ?* *R = 0.0821 L atm / mol K*

$$1.5\ atm\ x\ 3L = n\ x\ 0.0821\frac{L\ atm}{mol\ K}\ x\ 300K$$

$$\frac{1.5\ atm\ x\ 3L\ x\ mol}{0.0821\ L\ atm\ x\ 300} = 0.18 mol$$

There must be 0.18mol of gas.

3) Ms. Chen is inflating a bouncy castle with 3atm of pressure. The bouncy castle is 285K and requires 57 mol of gas. What volume of gas is required to fill the bouncy castle?

P = 3atm *T=285K* *n = 57 mol* *V = ?* *R = 0.0821 L atm / mol K*

$$3\ atm\ x\ V = 57\ mol\ x\ 0.0821\ \frac{L\ atm}{mol\ K}\ x\ 285K$$

$$V = \frac{57\ mol\ x\ 0.0821\ L\ atm\ x\ 285K}{3\ atm} = 445L$$

Ms. Chen would need 445L of air.

4) In order to find the volume of a gas using the ideal gas law equation, the variables can be rearranged as:

a. V = nRT/P
b. V = PRT/n
c. V = T/PRn
d. V = nPRT