Kinetic Molecular theory in regards to Gas laws (Thermochemistry)

- Standards:
  CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law)
  CHEM.B.2.2.2: Predict the amounts of reactants and products involved in a chemical reaction using molar volume of a gas at STP.

Knows (over course of 6 lessons):

- Boyle's Law (PV=P2V2)
- Charles's Law (V/T=V2/T2)
- Gay-Lussac's Law (P/T=P2/T2)
- Combined Gas Law (PV/T=P2V2/T2)
- Avogadro's Principle
- Ideal Gas Law (PV=nRT)

Dos:

- Recall previous knowledge
- Define content and vocabulary
- Illustrate different parts of Kinetic Molecular Theory
- Discuss how gases change from differences in pressure, temperature and volume
- Identify different gas laws
- Compare between Avogadro's Principle and the Combined Gas Law
- Hypothesize how gases would act differently on a different planet
- Analyze how gases react in different environments
- Designing and Developing
- Research
  - Reading and Writing

Benchmarks:

1. Create questions/problems in groups of 4 incorporating the different laws that we have gone over in class and have them pass it to another group to solve.
   a. If the questions are too easy, create some questions for the groups to have to answer instead.
   b. Each group creates 5 questions, and the teacher will add a few questions on top of them to check for understanding (Use GOOD HANDWRITING!)
   c. Have every student answer one question while explaining his or her thinking out loud to the rest of the group; the rest are done as a group.

2. Research different areas in every day life where we see ideal gas laws.
    a. Work in groups of 3(4?).
    b. Each group chooses a different area to research (i.e. electricity, breathing in walking/running, etc.)
    c. Each person has a different job: manager, recorder, reporter, illustrator
    d. Present this as a presentation: PowerPoint, Poster, Video, Prezi, etc.

Performance Task

- Research and choose a car from the AACA website that was made after 1898. Find and determine different parts of the car that incorporate the ideal gas laws. How do those parts use the laws? What laws do they use? For instance: If the volume is changed in the tires of that car, how does the psi (pressure) change as a result (Boyle's Law). Include what type of systems they are.
- Create a PowerPoint, Poster, Prezi, or another accepted form of assessment to hand in.

Lesson 1:

EQ: What is Boyle's Principle?

Objectives:

The students will be able to:

- Recall previous knowledge.
- Define content and vocabulary.
- Discuss how gases change from differences in pressure and volume.
- Illustrate differences in pressure and volume on a particle diagram.
- Analyze how gases react in different environments.

Activating Strategy:

- Blow up a balloon as full as possible. Have one student come up and try to pop the balloon by sitting on it. Class discussion about what they thought happened and why.

Standards:

- CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law)

Game Plan:

1. Welcome students, talk about necessary announcements about school/grades/class etc. (5)
2. Ask students if there is anyone who would like to blow up a balloon as full as possible—another to tie it—another for the “last activity” (3)
3. Hint at ideas of gases, give a little refresher about gases, and how today we will begin our discussion on the ideal gas laws, beginning with Boyle’s Law. (3)
4. Draw Boyle’s Law on the board. (1)
5. Have student sit on balloon and try to pop it. (1-2)
6. Once popped, ask students about what caused the balloon to pop, or didn’t pop. (1-5)
7. Have class discussion to talk about how volume played a part. (2-3)
8. Talk about the parts of Boyle’s Law. (2)
9. Have the students diagram in groups what they saw from the balloon in terms of Boyle’s Law. (8)
10. Discuss what the students had on their boards. (10)

Summarizing Strategy:

- Exit ticket, what is Boyle’s Principle?

Assessment:

- Whiteboards
- Exit Ticket

Differentiation:

- Showing demonstration
- Class discussion
- Group work
- Visual/auditory learning
- Kinesthetic (whiteboard)
- Illustrating on whiteboard
- Logical/mathematical
- Interpersonal
- Intrapersonal

Does not require a lot of change in the form of differentiation. This lesson not only has a small lecture portion for visual/auditory, kinesthetic with the whiteboards, illustrations with the whiteboards, but also group work for integration.

I will have to let a student with certain special needs know what will be happening before hand (the balloon popping) so they are not startled by the pop. Not many differences in differentiation are required for this lesson.

Materials:

- Balloons
- Chalk
- Whiteboards
- Working markers
- Exit ticket

Lesson 2:

EQ: What are Charles's Law and Gay-Lussac's Law?

Objectives:

The students will be able to:

- Recall previous knowledge
- Define content and vocabulary
- Discuss how gases change from differences in volume and temperature.
- Illustrate differences in volume and temperature on a particle diagram.
- Analyze how gases react in different environments.

Activating Strategy:

- Blow up a balloon slightly. Hold this above a Bunsen burner flame for a little bit and allow the air to heat up, which would subsequently increase the volume of air in the balloon.

Standards:

- CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law)

Game Plan:

1. Welcome students, talk about necessary announcements about school/grades/class etc.
2. Review with students the kind of relationship between volume and temperature (direct), pressure and temperature: direct relationship.
3. Activating Strategy
4. Review what happened with the balloon volume as the temperature of the air increased. What happened with the pressure as temperature increased?
5. Write the mathematical relationships on the board.
6. Have students take out whiteboards in groups and draw what they think the relationship between volume and temperature/pressure and temperature would be.
7. Review.
8. Have the students go over the whiteboards again and in 3 particle diagrams, explain what is happening to the particles as temperature increases in the balloon.
9. Go over as a class what the particles are doing.
10. Keeping those in mind, give them example problems of both laws and do together on the smart board.

Summarizing Strategy:

- In groups, whiteboard what the relationships between Volume/Temp and Pressure/Temp

Assessment:

- Whiteboards of graphs/particle diagrams
- Conversations in groups/as a class
- Exit Ticket

Differentiation:

- Showing demonstration
- Class discussion
- Visual/auditory/kinesthetic
- Group work
- Verbal
- Logical/Mathematical
- Interpersonal
- Intrapersonal

This lesson, like the previous one, will require some notification to a student who is possibly easily startled to bear in mind that the balloon may pop. The student will not need to worry about writing anything down, as they will be working in groups on the whiteboards that they will present and explain to me. If they have issues writing down for the exit ticket, I can separately ask them what is happening to see what they have understood from the class.

Materials:

- Balloons
- Whiteboards
- Smart Board
- Markers
- Exit tickets

Lesson 3:

EQ: What are the Combined Gas Law and Avogadro's Principle?

Objectives:

The students will be able to:

- Recall previous knowledge.
- Define content and vocabulary.
- Explain how gases change from differences in volume, temperature and pressure.
- Illustrate how gases changes from differences in volume, temperature and pressure at the particle level through particle diagrams.
- Express how Boyle's Law, Charles's Law, and Gay-Lussac's Law can be used and manipulated together.
- Determine Avogadro's Principle
- Compare between Avogadro's Principle and the Combined Gas Law
- Complete the first benchmark

Activating Strategy:

- Entrance ticket: students will take an entrance ticket that will have them answer, "In terms of mathematical relationships, describe/show the three main gas laws." They will hand this in and we will talk about it.

Standards:

- CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law)

Game Plan:

1. Hand out entrance tickets to students to fill out.
2. Welcome students, talk about necessary announcements about school/grades/class etc. Collect tickets.
3. Ask one or two students to give the answer they gave in their own words.
4. Review with students the relationships of each law.
5. Ask students what they think the Combined Gas Law is based off of the previous laws we had gone over. Explain.
6. Same with Avogadro's Principle.
7. Do example problem with them on the board.
8. BENCHMARK: Create questions/problems in groups of 4 incorporating the different laws that we have gone over in class and have them pass it to another group to solve.
    e. If the questions are too easy, create some questions for the groups to have to answer instead.
    f. Each group creates 5 questions, and the teacher will add a few questions on top of them to check for understanding (Use GOOD HANDWRITING!)
    g. Have every student answer one question while explaining his or her thinking out loud to the rest of the group; the rest are done as a group.

Summarizing Strategy:

Review Combined gas law

Assessment:

- Entrance tickets
- Benchmark (conversations)

Differentiation:

- Class discussion
- Work on the board
- Group work
- Visual/auditory/kinesthetic
- Logical/Mathematical
- Interpersonal
- Intrapersonal

This lesson is very relaxed for each student. The entrance ticket can be explained to the students if they don't understand to tell them that it's not graded in any way, I just wanted to see where everyone is with his/her knowledge of the content and where I can help out more. For hearing impaired, the directions could be written out for them on a piece of paper that they can read as I explain to the class what is happening. For LD, a somewhat simplified version of the entrance ticket and/or the benchmark can be provided for him/her.

Materials:

- Entrance tickets
- SmartBoard/Chalkboard
- Pencils/paper

Lesson 4:

EQ: What is the Ideal Gas Law?

Objectives:

The students will be able to:

- Recall previous knowledge
- Define content and vocabulary
- Define the different parts of the Ideal Gas Law
- Express what the Ideal Gas Law is explaining in own words and how it compares to "real" gases

Activating Strategy:

- Think-Pair-Share: Answer, "what is the difference between Avogadro's principle and the Combined Gas Law, aka how can Avogadro's principle be used with the Combined Gas Law?" individually, then compare with other group members to come up with a group consensus.

Standards:

- CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law)

Game Plan:

1. Welcome students, talk about necessary announcements about school/grades/class etc.
2. Think-Pair-Share.
3. Model Ideal Gas Law: have some students stand up and randomly walk around in a “real” gas way, then have others in an “ideal” gas way throughout the room to give a visual of the difference.
4. White board particle diagrams of what is happening between the two.
5. Show students the equation for the Ideal Gas Law and explain the components. Do example problem on board.
6. Give groups of students three different problems to do (most groups will do the same question as another group) on the whiteboards to go over as a class.
7. Introduce next idea for benchmark for tomorrow during class:

   Research different areas in every day life where we see ideal gas laws.
   a. Work in groups of 3(4?).
   b. Each group chooses a different area to research (i.e. electricity, breathing in walking/running, etc.)
   c. Each person has a different job: manager, recorder, reporter, illustrator

   Present this as a presentation: PowerPoint, Poster, Video, Prezi, etc
8. They can choose groups right now. They should start thinking about some sort of subject matter that uses ideal gas laws.

Summarizing Strategy:

- Exit Ticket: How does Avogadro’s Principle factor into the Ideal Gas Law? What does it account for?

Assessment:

- Think-Pair-Share
- White boards
- Discussion
- Exit Ticket

Differentiation:

- Class discussion
- Work on the board
- Think-Pair-Share group work
- Visual/Auditory/Kinesthetic
- Logical/Mathematical
- Interpersonal
- Intrapersonal

This lesson could potentially be somewhat intense for some students. The Think-Pair-Share part could be relaxed as you would work with your group mates that the students have been working alongside for a while at this point. If there was a hearing impaired student, the instructions may be given out on a piece of paper as well as creating an in-depth worksheet of what is being explained so he/she can follow along. For LD, the student may need to pair with another student that is easygoing and/or work with the teacher to help talk about some of the details. Also, if necessary, instead of allowing for the students to choose groups in case of students getting left out, I could simply create the groups ahead of time to intermingle the abilities.

Materials:

- Exit Ticket
- Worksheet of Ideal Gas Law problems
- Walk through worksheet of what Ideal Gas Law is for hearing impaired
- Smarboard/Chalkboard/Markers

Lesson 5:

EQ: What are the different types of laws in the Ideal Gas Laws?

Objectives:

The students will be able to:

- Recall previous knowledge
- Express and review the different ideal gas laws
- Relate the ideal gas laws to every day life

Activating Strategy:

- Think-Pair-Share: Pair up with your group mates and come up with all of the different gas laws we have gone over, as well as the mathematical relationships that are used to determine them.

Standards:

- CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law)

Game Plan:

1. Welcome students, talk about necessary announcements about school/grades/class etc.

2. Think-Pair-Share

3. Re-introduce the Benchmark that was talked about yesterday, group them up again:

   Research different areas in every day life where we see ideal gas laws.
   a. Work in groups of 3(4?).
   b. Each group chooses a different area to research (i.e. electricity, breathing in walking/running, etc.)
   c. Each person has a different job: manager, recorder, reporter, illustrator

   Present this as a presentation: PowerPoint, Poster, Video, Prezi, etc

4. Work on that during class to present the following day (or so depending) to the rest of the class.

Summarizing Strategy:

- None for this lesson as this is a benchmark lesson.

Assessment:

- Think-Pair-Share
- Group work
- Discussion
- Benchmark

Differentiation:

- Class discussion
- Think-Pair-Share group work
- Visual/Auditory/Kinesthetic
- Logical/Mathematical
- Interpersonal
- Intrapersonal

This lesson is a very straightforward lesson as this is basically just a recap of everything that we have gone over as a class in this unit, and to determine how much they truly know and can show understanding of. The groups as stated in the previous lesson can be created by the teacher if I deem it necessary considering the type of class I have. For hearing-impaired student, the Think-Pair-Share can be typed out for them to read and answer alongside their group mates, as well as making sure they have a helpful and useful position in their group. For LD, it would help to go over the directions with them separately as they may be a little confusing, as well as having the benchmark typed out for him/her to read and given a helpful/useful position in the group.

Materials:

- Think-Pair-Share instruction paper
- Benchmark instructions paper
- Smartboard/Chalkboard/Markers

Lesson 6:

EQ: None, PT explanation and unit test.

Objectives:

The students will be able to:

- Demonstrate knowledge of the content
- Recall previous knowledge
- Illustrate differences between the laws

Activating Strategy:

- Introduce the Performance Task; hand out worksheet with rubric and directions on it and explain what the project will be looking for.
- Small, quick review going over the main ideas of what will be found on the exam to get them ready for the exam.

Standards:

- CHEM.B.2.2.1: Utilize mathematical relationships to predict changes in the number of particles, the temperature, the pressure, and the volume in a gaseous system (i.e. Boyle's law, Charles's law, Dalton's law of partial pressures, the combined gas law, and the ideal gas law)
- CHEM.B.2.2.2: Predict the amounts of reactants and products involved in a chemical reaction using molar volume of a gas at STP.

Game Plan:

1. Welcome them, tell them what they can expect for today and that they shouldn't be surprised that they have an exam today.
2. Hand out the worksheets that have the rubrics on them and explain what the expectations are on the project.
3. Give them the exam.
4. Give them some sort of candy as they leave.

Summarizing Strategy:

- None, because it's exam day.

Assessment:

- Unit exam

Differentiation:

- Not much, as this is a unit test that is required in one form or another. Another form that could be given could have fewer choices on the multiple choice, more time allotted, and/or taken in the resource room separately.

Materials:

- Performance Task WS rubric
- Unit Exam
- Extra calculators in case

Name_____

Read the Directions at the beginning of each part. **Make sure you understand** what the Directions **are asking** for **before** beginning. **ASK** any questions that you need **regarding the exam**; the worst thing I can say is "I cannot answer that right now." **GOOD LUCK!!!**

I) Directions: Match the word/concept from Column A to its definition in Column B. Write the letter of the definition next to the appropriate word/concept in the space in Column A.

Column A	**Column B**
_____1. Boyle's Law	A. Uses Volume, Pressure, Temperature, moles and the gas law constant, R.
_____2. Charles' Law	B. Measures the difference in gases by Volume and Pressure
_____3. Gay-Lussac's Law	C. A conversion from moles of a substance to molecules
_____4. Avogadro's Principle	D. Measures the difference in gases by Temperature and Pressure
_____5. Ideal Gas Law	E. Measures the difference in gases by Pressure, Volume, and Temperature
_____6. Combined Gas Law	F. Measures the difference in gases by Volume and Temperature

<u>II) Directions:</u> Read each question and answer each one in the space provided. Show calculations for partial credit.

7. 2.00 L of a gas is collected at 25.0 °C and 745.0 mmHg. What is the volume at STP?

8. 1.85 L of a gas is collected of water at 98.0 kPa and 22.0 °C. What is the volume of the dry gas at STP?

9. Determine the volume occupied by 2.34 grams of carbon dioxide gas at STP.

10. At what temperature will 0.654 moles of neon gas occupy 12.30 liters at 1.95 atm?

<u>III) Directions:</u> Select <u>one</u> of the essays below about which to write. Write in complete sentences, in the space below and on the other side of this test. Indicate which question number you are answering. You may draw a picture as well to assist your answer.

11. How can you use a balloon to explain the Ideal Gas Law(s)? Include particle movement.

OR

12. Explain the difference in the particle movement in solid, liquid, and gas states. Once you have a gas, explain how the particles would change from differences in volume, temperature, and pressure.

<u>IV) Directions:</u> Now that you have finished the test, is there something you want me to know you studied but you didn't get to demonstrate? Write in complete sentences.

<u>Extra Credit:</u> Why is water able to float when it is a solid instead of sinking?

	Superior	Outstanding	Adequate	Inadequate
Content 4 points	-The superior project contains all components of the assignment **and** has superior insight and application of content is strongly evident.	-Outstanding projects contain most or all of the components **or** have strong insight and application of content is evident.	-An adequate project contains some of the components **or** has good insight and application of content is somewhat evident.	-An inadequate project contains minimal to no amount of the content **or** little to no insight or application evident of content.
Parts of the Car 5 points	-A superior project contains every part of the car that incorporates ideal gas laws.	-An outstanding project contains most of the parts of the car that incorporates ideal gas laws.	-An adequate project contains one or more parts of the car that incorporates ideal gas laws.	-An inadequate project contains no parts of the car that incorporates ideal gas laws.
Ideal Gas Laws 8 points	-A superior project incorporates all the pertinent ideal gas laws. -He/She powerfully depicts and thoroughly explains the connections with the corresponding part(s) in the car.	-An outstanding project incorporates most or all the pertinent ideal gas laws. -He/She depicts and explains the connections with the corresponding part(s) in the car.	-An adequate project incorporates some of the pertinent ideal gas laws. -He/She somewhat depicts and explains the connections with the corresponding part(s) in the car.	-An inadequate project incorporates 1 or no ideal gas laws. -He/she does not show any connection with corresponding part(s) in the car.
Presentation 8 points	-A superior project uses a pre-approved form of assessment. -Very thorough, strong evidence of higher level of comprehension. -Clear voice, very confident, superior knowledge of information evident.	-An outstanding project uses a pre-approved form of assessment. -Thorough, shows evidence of comprehension. -Clear voice, confident, knowledge of information content.	-An adequate project uses a pre-approved form of assessment. -Somewhat thorough, shows some evidence of comprehension. -Somewhat clear voice, some knowledge of information content.	-An inadequate project does not use an accepted form of assessment. -Not thorough, with little/no evidence of comprehension. -Difficult to hear, shows little to no knowledge of information.

MUGS 5 points	-Grammar consistently accurate. -Few to no spelling errors.	-Grammar mostly accurate. -Some spelling errors.	-Grammar somewhat accurate. -Many spelling errors.	-Numerous grammar mistakes. -Numerous spelling errors.