Lesson Plan – Book-stacking Activity

Name: Wilton Wong Mentor: _____

Grade Level: 9-12 Chemistry School: _____ Date: _____

Content Standard: 9-12 Chemistry Element(s): Reaction Rates – 8a, b

- **Describe desired outcomes**. Identify what students will know and be able to do. Specify key knowledge, skills and/or understandings that will result from this lesson.

This activity will introduce the notion of pressure. By the end of the activity, students will understand the formula for pressure in practical terms. Ultimately, this activity will lead students to address the following standards:

8. Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. As a basis for understanding this concept:

a. *Students know* the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.

b. *Students know* how reaction rates depend on such factors as concentration, temperature, and pressure.

- **Identify evidence of learning**. Clarify how students will demonstrate their understanding, knowledge and/or skills. Determine the product or assessment that will be evidence of student learning.

Students who understand pressure will end up cutting or tearing the paper into strips and rolling them into columns. Then they will place several columns under books to show that the larger the area they cover by using several columns, the less the pressure placed on each column is. This is, essentially, the formula for pressure.

- **List materials needed**. Determine what materials and resources you will need during the lesson.

Meterstick
Sheet of paper
Access to several textbooks

- **Open the lesson**. Connect students' prior knowledge, life experiences and interests with the learning goals of the lesson. Motivate, pique interest and engage the learner.

Tell students they will be proving the formula for pressure, but you don't want to give away too much—you want them to discover it on their own!

- **Provide instruction and modeling**. Outline what you are going to teach and how. Sequence the instruction, and plan how you will differentiate the content and/or instructional methods to meet the learning needs of the students.

Give each group one piece of paper.
Explain that the goal is to use this piece of paper to stack as many books as possible one inch off the table top, one on top of another.
Discuss teacher expectations:

Not permitted:

- Tape
- Glue

Permitted:

- Cutting
- Tearing
- Shaping one piece of paper in any way

Expectations:

- Students will develop their own design
- If they are not initially successful, they will seek another design

- **Facilitate guided practice**. Plan student practice and interaction with the subject matter. Differentiate the process, content and/or product(s). Specify procedures, structures and time frames.

Give students time to conduct the activity, while monitoring their work.

- **Close the lesson**. Summarize, debrief the lesson and/or foreshadow next steps.

Ask students to discuss, as a whole class, what they discovered about distributing the weight of the books. Perhaps ask students to translate what they've learned about pressure into an equation.

- **Plan independent practice or review**. Create a follow-up that students could do as homework or that could be used as review the next day.

The following day in class, use the various elements of the activity to explain the formula for pressure is force divided by area. (The force is the books, the area is the size of the books covering each column, etc.)

Lesson Plan – Balloon Activity

Name: Wilton Wong Mentor: _____

Grade Level: 9-12 Chemistry School: _____ Date: _____

Content Standard: 9-12 Chemistry Element(s): Gases and their properties – 4 a, b & 8 a, b

- **Describe desired outcomes**. Identify what students will know and be able to do. Specify key knowledge, skills and/or understandings that will result from this lesson.

This activity will introduce the properties of gas and serve as a way to engage students. The goal is for students to observe how gas creates pressure.
Ultimately, this activity will lead students to address the following standards:

4. The kinetic molecular theory describes the motion of atoms and molecules and explains the properties of gases. As a basis for understanding this concept:

a. *Students know* the random motion of molecules and their collisions with a surface create the observable pressure on that surface.

b. *Students know* the random motion of molecules explains the diffusion of gases.

8. Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. As a basis for understanding this concept:

a. *Students know* the rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.

b. *Students know* how reaction rates depend on such factors as concentration, temperature, and pressure.

- **Identify evidence of learning**. Clarify how students will demonstrate their understanding, knowledge and/or skills. Determine the product or assessment that will be evidence of student learning.

Students will write a brief reflection in their lab books that hypothesizes why the balloon expands. They will use these as a springboard for a think-pair-share activity.

- **List materials needed**. Determine what materials and resources you will need during the lesson.

Bottle of water
Alka seltzer
Balloon

- **Open the lesson**. Connect students' prior knowledge, life experiences and interests with the learning goals of the lesson. Motivate, pique interest and engage the learner.

Explain to students that this is a demonstration to help them observe how gas creates pressure.

- **Provide instruction and modeling**. Outline what you are going to teach and how. Sequence the instruction, and plan how you will differentiate the content and/or instructional methods to meet the learning needs of the students.

Teacher will complete the demonstration:
Drop alka seltzer into the bottle of water.
Attach a balloon to the end of the bottle.
Tell students to watch as the balloon collects the gas from the alka seltzer.

- **Facilitate guided practice**. Plan student practice and interaction with the subject matter. Differentiate the process, content and/or product(s). Specify procedures, structures and time frames.

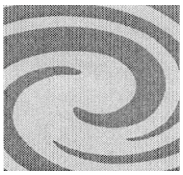
Ask students to write an explanation of what they think is happening.
Provide time for students to share their thoughts with a partner.

- **Close the lesson**. Summarize, debrief the lesson and/or foreshadow next steps.

Have students share some of their comments and questions with the rest of the class. Record any questions they have on the board to return to during the rest of the unit.

- **Plan independent practice or review**. Create a follow-up that students could do as homework or that could be used as review the next day.

Assign homework that includes textbook reading about the relationship between gas and pressure.



Lesson Plan – Hydrogen Gas Lab

Name: Wilton Wong Mentor: _____

Grade Level: 9-12 Chemistry School: _____ Date: _____

Content Standard: 9-12 Chemistry Element(s): Gases and their properties – 3 a, d, e

- **Describe desired outcomes**. Identify what students will know and be able to do. Specify key knowledge, skills and/or understandings that will result from this lesson.

This activity will provide students the opportunity to practice writing hypotheses, set up labs, record information, and analyze results. The lab itself will address the following standards:

3. The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. As a basis for understanding this concept:

a. *Students know* how to describe chemical reactions by writing balanced equations.

d. *Students know* how to determine the molar mass of a molecule from its chemical formula and a table of atomic masses and how to convert the mass of a molecular substance to moles, number of particles, or volume of gas at standard temperature and pressure.

e. *Students know* how to calculate the masses of reactants and products in a chemical reaction from the mass of one of the reactants or products and the relevant atomic masses.

- **Identify evidence of learning**. Clarify how students will demonstrate their understanding, knowledge and/or skills. Determine the product or assessment that will be evidence of student learning.

Students will determine the volume of the hydrogen gas that's produced from a sample of magnesium reacting with hydrochloric acid. They will measure the gas volume at room temperature and pressure. The evidence of learning will be in the form of their data and in their response to the question: How many liters of dry hydrogen gas at room temperature and pressure can be produced per mole of magnesium metal? What would be the molar volume of gas at STP?

- **List materials needed**. Determine what materials and resources you will need during the lesson.

250 mL beaker
Ring stand
Funnel
Ruler
Thermometer
Gas measuring tube (eudiometer) (50 mL)
One hole stopper to fit eudiometer
1000 mL graduated cylinder
Utility clamp (single buret)
Magnesium ribbon (5-6 cm)
Hydrochloric Acid (6 M)
Water

- **Open the lesson**. Connect students' prior knowledge, life experiences and interests with the learning goals of the lesson. Motivate, pique interest and engage the learner.

Review with students what they already know about the reaction rates of metals.
Have students brainstorm what they know about magnesium gas and hydrochloric acid and how they interact.
Explain that the goal of this lab is to determine the molar volume of hydrogen gas at STP.

- **Provide instruction and modeling**. Outline what you are going to teach and how. Sequence the instruction, and plan how you will differentiate the content and/or instructional methods to meet the learning needs of the students.

Partner students to write their own hypotheses for measuring how much magnesium gas could be dissolved by hydrochloric acid.
Give students time to develop their lab procedure.
Review safety before allowing students to practice the lab.
[Can differentiate by doing a demonstration or by providing the procedure for students rather than letting them figure out the variables on their own.]
Review the formulas for calculating volume and remind students they will be recording the calculations and measurements of volume as part of their formal lab write-up.

- **Facilitate guided practice**. Plan student practice and interaction with the subject matter. Differentiate the process, content and/or product(s). Specify procedures, structures and time frames.

Monitor lab partnerships/groups as they work.
Could have students volunteer what they believe procedure should be or specify procedure:

Measure the magnesium ribbon.
Calculate the mass of the ribbon (based on the given mass of 100.0 cm of the ribbon).
Fill graduated cylinder to the top with tap water.
Tilt the gas-measuring tube and pour about 10 mL of the HCl.

Slowly fill the tube with tap water, using the 250 mL beaker. Rinse down any acid that may be on the side of the tube while you do this. Avoid stirring up the acid layer at the bottom of the tube.
Place the magnesium strip in the gas tube. The gas tube should be full so that some water flows out the stopper hole when the stopper is put in.
Cover the stopper hole and invert the tube in the 1000mL graduated cylinder of water. The acid should fall down through the water and react with the metal.
Wait 2 minutes after the reaction ends to allow the temperature to equalize.
Dislodge any bubbles on the tube side by tapping the tube gently.
Lower or raise the gas tube until the liquid level inside is the same as the level outside the tube. This allows measurement of the volume at room pressure.
Read the gas volume.
Record the water temperature in the cylinder.
Remove the gas-measuring tube and pour the acid solution down the sink.
Record the atmospheric pressure.
Record the vapor pressure of water vapor at the temperature of the water.

- **Close the lesson**. Summarize, debrief the lesson and/or foreshadow next steps.

Let students know when there are 10 minutes remaining and 5 minutes remaining for them to complete the lab.
After students clean up and put things away, review with them what general things they noticed.

- **Plan independent practice or review**. Create a follow-up that students could do as homework or that could be used as review the next day.

Ask students to complete their calculations for homework and to write up their preliminary findings. Here are some calculations they should complete on their own:

1. Determine the pressure of the hydrogen gas at room temperature and pressure.
2. Determine the volume of dry hydrogen gas at standard temperature and pressure (STP).
3. Calculate the volume of dry hydrogen that would be produced with one mole of magnesium.

After students complete their independent practice, in class, have students compare the amount of hydrogen they created from one mole of Mg at STP with the accepted amount and show them how to calculate the error.