Chemistry 12.1

Goals: Define the mole and calculate molar masses

Bellwork: Describe three ways you could measure a quantity of sugar in a cup

Plan:

- Discuss bellwork: units that can be used (mass, volume etc)
- Discussion: could you count the grains to sugar? Advantages and disadvantages to this method. Is there a way to determine the number without counting every single one?
- Demo: determining the amount of balls in a model kit. How can we determine the total number by weighing one?
- Define "the mole" in chemistry
- Avogadro's number 6.02×10^{23}, how big it is and what does it mean
- Guided practice, calculating molar masses from the periodic table
- Independent practice: calculating molar masses of different compounds given the formula

HW: molar mass calculation worksheet

Students will be able to:

- Define and describe the methods to determine a mole of a substance
- Calculate the molar masses of different compounds using the periodic table

12.2

Goals: Determine how to convert moles to grams and vice versa

Bellwork:

1) How many eggs are in a dozen?
2) If you were a farmer and you collected 36 eggs, how many dozen would that be?
3) What if you collected 131 eggs? How many dozen is that?

Plan:

Compare a dozen to a mole: mole is to dozen as grams is to eggs.

Guided practice, converting known amounts of a substance into moles

> dimensional analysis review

Independent practice: conversions using molar masses as conversion factors

HW: moles: grams conversion worksheet

12.3

Goals: Demonstrate how mass is affected in a chemical reaction

Bellwork:

- Determine the molar mass of sodium bicarbonate $NaHCO_3$
- What is the molar mass of carbon dioxide?
- What would be the mass of the sodium bicarbonate if it were to release a carbon dioxide from this molecule?

Plan:

- Students will investigate how to determine the amount of gas released in a chemical reaction

Conservation of mass lab

Purpose: To investigate the masses before and after a chemical reaction

Methods: Experiment 1

1) Fill a flask with vinegar (acetic acid). The exact volume doesn't matter, but aim for a volume of around 125 mL
2) Place the flask with vinegar on the balance and determine the mass (in grams)

   Mass _____

3) Collect some baking soda (sodium bicarbonate) and note the mass on the electronic balance
4) Add the mass from step 2 to the mass of the baking soda

   Total mass _____

5) Add the baking soda to the flask and allow it to react completely. Make a note as to if anything escapes from the flask during the reaction

Observations:

6) Determine the new mass of your flask. Subtract the total mass in #4 with the new mass in the flask.

New mass _____ Mass difference_____

7) Record the mass difference up on the whiteboard
8) How does your mass difference compare with the other data collected in class? If the data is consistent, why do you think this is the case? If the mass differences are completely different,

what is your hypothesis as to why this is the case? (you can wait to answer this question until you have sufficient data)

Methods: Experiment 2

Set up is similar to the first experiment with the following changes:

- Place the baking soda inside a balloon (use a funnel to transfer)
- Fit the balloon over the top of the flask but don't dump in the baking soda yet
- Determine the mass of your entire flask-balloon system

Mass _____

- Dump in the baking soda and record your observations

Observations:

- Determine the new mass of your entire flask-balloon system (DO NOT remove the balloon)

New mass _____

1) Describe why your results for this experiment are consistent with what you have learned about chemical reactions.

2) If the mass changed in experiment 1 (without the balloon), is it because atoms and molecules were created or destroyed? Support your answer and give the reason the mass changed in that experiment.

3) What ways would you change the methods or equipment of this lab to get more consistent results among all the groups?

Calculations (this may be detached and completed for homework if no time in class)

Mass of sodium bicarbonate used _____

Experiment 1 mass lost _____

Molar mass of sodium bicarbonate _____

Molar mass of carbon dioxide _____

Molar mass of acetic acid _____

1) How many moles of sodium bicarbonate were used in this experiment? (show work)

2) Assume all the mass that escaped from the flask was carbon dioxide. How many moles of carbon dioxide were made from this reaction? (show work)

3) Suppose that you suspect that half of the mass difference was due to carbon dioxide but that the other half was acetic acid that escaped from the flask. Determine the theoretical amount of moles that escaped from the flask that was acetic acid (show work)

Enrichment:

Commercial vinegar is 5% acetic acid diluted in water. Propose a method to determine the average molar mass of a sample of vinegar (use the back of this paper to describe method and show sample calculations)