## Class Lab #12: How many molecules of water are in a bag of popcorn?

**Learning Objective**: To determine the number of molecules of water lost by a bag of popcorn.

Materials**:**

Bag of popcorn

Microwave

Balance

## Data/Observations

|  |  |  |
| --- | --- | --- |
|  | **Mass** | **Observations (at least 2 per box)** |
| Mass of unpopped kernels + bag |  (g) |  |
| Mass of popped kernels + bag |  (g) |  |
| Mass of water lost |  (g) |  |
| Mass of bag | (g)  |  |

## PHASE I: Conservation Laws

1. Why did the popcorn bag inflate as heat was added to it?

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2. Draw a particle diagram that shows **what happened to the water** in the popcorn bag before and after adding heat to it. Be sure to label: water as a vapor and water as a liquid.

After heating

Before heating

3. Define the following Laws of Conservation.

 **Conservation of Energy** =

 **Conservation of Mass (Matter)** =

3. In terms of the conservation laws, **explain** your observations for the mass of the closed popcorn bag before and after heating it?

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4. In terms of conservation laws, **explain** your observations for what happened to the mass of the popcorn bag after opening up the bag?

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## PHASE II: Mass to Moles

1. What is the definition of a **mole**?

2. How many Hydrogen atoms are in one molecule of H2O? \_\_\_\_\_\_\_\_\_

3. How many Oxygen atoms are in one molecule of H2O? \_\_\_\_\_\_\_\_\_

4. How many **grams** are in one mole of H2O?

5. What is the **mass** of H2O in a bag of popcorn? [Write down every step.]

6. What is Avogadro's number with units? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. Using the **mass** of water and Avogadro's number, how many **moles** of water is that? [Write down every step with proper units.]

*\*\*Turn to PAGE 5 and complete the practice problems for PHASE II.\*\**

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## PHASE III: Moles to Molecules

1. Using the number of **moles** of water you calculated, how many **molecules** of water is that? [Write down every step with proper units.]

*\*\*Turn to PAGE 6 and complete the practice problems for PHASE III.\*\**

## Further Application of Moles

## Phase IV. Moles to Volume

1. How many liters are in one mole of a gas? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Using the number of **moles** of H2O from phase II, what is the total **volume** of the water vapor that escaped the popcorn kernels? [Write down every step with proper units.]

*\*\*Turn to PAGE 7 and complete the practice problems for PHASE IV.\*\**

## Phase V. Percent composition

1. What is the percent composition formula/equation?

2. What is the mass of the popcorn alone (minus the bag)?

 Mass of just popcorn kernels before heating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Mass of just popcorn after heating \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. What is the **percent composition** of water in a bag of popcorn? [Write down every step with proper units.]

*\*\*Turn to PAGE 8 and complete the practice problems for PHASE V.\*\**

## PRACTICE PROBLEMS

## Phase II: Moles to Mass

Calculate the gram formula mass (molar mass) for the following compounds:

1. HCl

2. SiH4

3. C3H6O2

4. Fe(NO3)3

Calculate the moles present in:

1) 2.00 grams of H2O

2) 75.57 grams of KBr

3) 100. grams of KClO4

4) 8.76 grams of NaOH

Calculate the grams present in:

1) 0.200 moles of H2S

2) 0.100 moles of KI

3) 0.750 moles of NaOH

4) 3.40 x 10-5 moles of Na2CO3



Check point! Get this box signed by the teacher upon completion before moving on. \_\_\_\_\_\_

## Phase III: Moles to Molecules

The first two problems are one-step problems and the second two are the two-step problems.

What is Avogadro's number with units? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1) Calculate the number of molecules in 1.058 mole of H2O

2) Calculate the number of atoms in 0.750 mole of Fe

3) Calculate the number of molecules in 1.058 gram of H2O

4) Calculate the number of atoms in 0.750 gram of Fe

5) Which contains more molecules: 10.0 grams of O2 or 50.0 grams of iodine, I2?



Check point! Get this box signed by the teacher upon completion before moving on. \_\_\_\_\_\_

## Phase IV: Moles to Volume

1. How many liters are in one mole of a gas at STP (standard temperature and pressure)?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What volume is occupied by 5 moles of any gas at STP?

3. How many liters will 48.6 grams of CO2 occupy at STP?

4. What volume is occupied by 100.0 grams of chlorine gas (Cl2) at STP?

5. What is the mass in grams of 17.0 liters of methane gas (CH4) at STP?

6. What volume is occupied by 12.5 moles of nitrogen gas at STP?



Check point! Get this box signed by the teacher upon completion before moving on. \_\_\_\_\_\_

## Phase V: Percent Composition

Calculate the percent composition for each compound listed. As in, find the percentage of each element's mass out of the total mass of the compound.

|  |
| --- |
| Percent composition formula = |

1) KNO3

2) H2SO4

3) C2H5OH

4) C6H5NH2



Check point! Get this box signed by the teacher and hand it in! You’re done! \_\_\_\_\_\_