**POGIL: Using Moles**

**Warm-Up:**

1. How many eggs are there in a dozen eggs?

2. How many pencils are in two dozen pencils?

3. A conversion factor is a ratio that helps you convert from one unit to another. A conversion factor is made from two equal quantities that can be written as a ratio, as shown in the example below:

Example: 12 objects = 1 dozen objects

Conversion factors: 1 dozen 12 eggs

12 eggs 1 dozen

Conversion factors make it easier to convert between units. When you use a conversion factor, you always MULTIPLY your conversion factor by a starting value, and you choose the factor that puts your starting units on the bottom and the units you want on the top.

**STARTING VALUE x UNITS YOU WANT = FINAL ANSWER**

**UNITS YOU GOT**

EXAMPLE: Convert 24 eggs to dozens.

**24 eggs x 1 dozen = 2 dozen**

**12 eggs**

4. We use conversion factors in this way to make sure our units cancel out. Cross off any units that cancel out in the equation above. How do you know they cancelled out?

**So where do moles fit in????**

Just like a dozen is a unit used for counting objects, the **mole** (mol) is also used for counting objects. It is especially useful for counting tiny objects like atoms, molecules, ions, and formula-units, because a mole is a very, very large number:



**1 mole of objects = 6.022 x 1023 objects**

7. How many atoms of copper are in 1 mole of copper?

8. How many molecules of water are in 1 mole of water?



9. Write two forms of the conversion factor that will convert one mole to number of objects and number of objects to moles (look at the two conversion factors given for dozens).

10. Using the appropriate conversion factor in # 8, how many atoms of zinc are in 10.2 moles of zinc?

11. Using the appropriate conversion factor in # 8, find out many moles of water contain 1.51 x 1024 molecules of water.

12. The Donald W. Reynolds Razorbacks Stadium holds approximately 72,000 fans. Express this number in moles.



**PART 2: Molar Mass**

Atoms and molecules are extremely small. Because of this, scientists measure the mass of atoms relative to the mass of a chosen standard atom. This standard atom is the carbon-12 atom. The carbon-12 atom has been assigned a mass of exactly 12 atomic mass units (amu).

We have already learned in class that atomic mass corresponds roughly to the number of protons + the number of neutrons in an atom, but atomic mass units are important for something else, too! Atomic mass units are used to show the mass (in grams) for one mole of a particular atom or molecule.

1. What does amu stand for?

2. Circle the atomic mass units for each of the elements shown below:

**Hydrogen**

**1**

**H**

**1.00794**

**Carbon**

**6**

**C**

**12.011**

**Sodium**

**11**

**Na**

**22.98**

3. How much does 1 mole of hydrogen weigh?

***CONGRATULATIONS!! You just calculated MOLAR MASS for hydrogen!!!***

4. How much does 1 mole of carbon weigh?

5. How much does 1 mole of sodium weigh?

6. What is the relationship between molar mass in grams per mole (g/mol) and average atomic mass in amu of each element?

7. Using what you have learned so far, fill the blanks in the boxes below.

|  |  |  |
| --- | --- | --- |
| Molar mass of Pb = | Molar mass of Al = | Molar mass of N = |

8. Using molar mass (g/mol) as a conversion factor, how much would 6 moles of nitrogen weigh?

9. Using g/mol as a conversion factor, find how many moles of aluminum are in 10 g of aluminum.

10. Use your answer from #9 to find how many atoms are present in 10 g of aluminum. Is the number what you expected? Why or why not?