WODSS SCIENCE Name: _____

SCH 4CI Date: _____

Measurements and Conversion Factors

There are many kinds of measurements in the world. One that we are familiar with is the dozen. (**a dozen = 12).** This can be a dozen of anything. A dozen eggs, a dozen donuts, buns etc.

How many eggs are in 8 dozen eggs? You know how to do this.

$$\text{\# of eggs} = 8 \text{ dozen} \times \frac{12 \text{ eggs}}{1 \text{ dozen}} = \_\_\_\_\_ \text{ eggs}$$

How many donuts are there in 6 dozen?

$$\text{\# of donuts} = 6 \text{ dozen} \times \frac{12 \text{ donuts}}{1 \text{ dozen}} = \_\_\_\_\_ \text{ donuts}$$

Another measurement is called a ream. **1 ream = 500 sheets of paper**
List the possible conversion factors from the equation above:

[Multiply the key values below by the correct conversion factor so that the given units cancel, and the required units remain.]
How many sheets of paper are in 5 reams?

How many sheets of paper are in 6 ½ reams?

How many reams are in 3250 sheets of paper?

Avagadro's constant and the Mole

In Chemistry, we don't talk about a certain number of atoms reacting, because atoms are too small to count. We'd be talking of HUGE numbers if we were counting atoms. Instead we use a quantity called a _____.

1 mole = 6.022 X 10^{23} particles (these can be _____)

= 602 200 000 000 000 000 000 000 particles!!

The number 6.02 X 10^{23} is called _____. Avagadro realized that 6.02 X 10^{23} atoms of any element have a mass, in grams, that is equal to the numerical value of the element's atomic mass.

Example – one atom of carbon has a mass of _____, and one mole of carbon has a mass of _____.

One atom of iron has a mass of _____, and one mole of iron has a mass of _____.

We can use Avagadro's constant to calculate the number of moles of a substance, or the number of particles in a substance. We use the follo9wing symbols in our calculations.

Symbol	Quantity	Unit
n	# of moles	
N	# of particles	
N_A	Avagadro's number (6.02 x10^{23})	

Example:

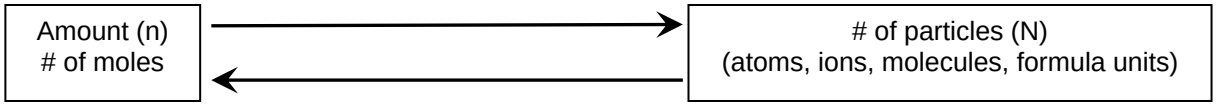
1. How many particles in 3 moles?

   3 moles X $\frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mole}}$ = _____ particles

2. How many moles are in 8.27×10^{23} particles?

   $8.27 \quad 10^{23}$ particles X $\frac{1 \text{ mole}}{6.022 \times 10^{23} \text{ particles}}$ = _____ moles

3. Complete the graphic organizer below to help you convert from moles to number of particles. Note that the arrow points towards the REQUIRED piece of information (what you are trying to figure out).



4. How many atoms does a 2.6 mol sample of silver have?

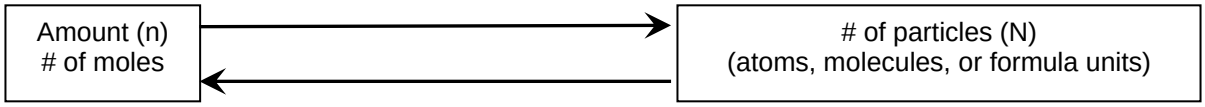
5. A sample contains 1.25 mol of NO_2.
   a. How many molecules are there?

   b. How many atoms are there in the sample?

6. How many moles are there if a sample of NaCl contains 3.21×10^{23} formula units?

Avogadro's Constant Problem Set

Helpful hint:



1. A small pin contains 0.0178 mol of iron. How many atoms of iron are in the pin?
2. A sample contains 0.02 mol of gold. How many atoms of gold are in the sample?
3. A sample of Al_2O_3 contains 7.71×10^{24} formula units. How many moles of aluminum oxide are there?
4. How many formula units are contained in 0.21 mol of magnesium nitrate?
5. A vat of cleaning solution contains 8.03×10^{23} molecules of ammonia (NH_3). How many moles of ammonia are in the vat?
6. A litre of water contains 55.6 mol of water. How many molecules of water are in the sample?
7. A typical bottle of nail polish remover contains 2.5 mol of ethyl acetate ($C_4H_8O_2$).
   a. How many molecules of ethyl acetate are in the bottle?
   b. How many atoms are in the bottle?
   c. How many carbon atoms are in the bottle?
8. Consider a 0.829 mol sample of sodium sulfate (Na_2SO_4).
   a. How many formula units are in the sample?
   b. How many sodium ions are in the sample?
9. A sample of cyanic acid HCN, contains 1.11×10^{22} molecules. How many moles of cyanic acid are in the sample?
10. CHALLENGE QUESTION: A sample of pure acetic acid, CH_3COOH, contains 1.40×10^{23} carbon atoms.
    a. How many molecules of acetic acid are there? Hint: think about how many carbon atoms are in each molecule.
    b. How many moles of acetic acid are there?

ANSWERS:

1. 1.07×10^{22} atoms 2. 1.2×10^{22} atoms 3. 12.8 mol 4. 1.26×10^{23} formula units 5. 1.33 mol
6. 3.34×10^{25} molecules 7. a) 1.5×10^{24} molecules b) 2.1×10^{25} atoms c) 6.0×10^{24} C atoms
8.a) 4.99×10^{23} formula units b) 9.98×10^{23} Na^+ ions 9. 0.018 mol 10.a) N = 7×10^{22} molecules b) 0.12 mol