

**Mole Conversions Worksheet**  
**Working with Moles and Particles**

**There are three mole equalities. They are:**

$$1 \text{ mol} = 6.02 \times 10^{23} \text{ particles (atom, molecule or ion)}$$

$$1 \text{ mol} = \text{gram formula mass of a substance}$$

$$1 \text{ mol} = 22.4 \text{ L for a gas at STP}$$

**The equality for moles and particles can be written as a set of two conversion factors:**

$$\left( \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ particles}} \right) \quad \text{OR} \quad \left( \frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mole}} \right)$$

**Mole-Particle Conversion Calculations: Using the Factor-Label Method**

1. How many moles of magnesium is  $3.01 \times 10^{22}$  atoms of magnesium?

$$3.01 \times 10^{22} \text{ atoms} \left( \frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ atoms}} \right) = 5 \times 10^{-2} \text{ moles}$$

When the units are set up properly, the unit you are converting **FROM** will cancel out.

You are left with the desired unit you are converting **TO**.

2. How many molecules are there in 4.00 moles of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ ?

$$4.00 \text{ moles} \left( \frac{6.02 \times 10^{23} \text{ molecules}}{1 \text{ mole}} \right) = 2.41 \times 10^{24} \text{ molecules}$$

3. How many moles are  $1.20 \times 10^{25}$  atoms of phosphorous?

4. How many atoms are in 0.750 moles of zinc?

5. How many molecules are in 0.400 moles of  $\text{N}_2\text{O}_5$ ?

Name \_\_\_\_\_

Date \_\_\_\_\_

6. How many atoms are in 0.340 moles of sodium?

7. How many moles are in  $1.204 \times 10^{24}$  molecules of Bromine?

8. How many molecules are in 0.75 moles of oxygen gas?

9. How many moles are present in  $2.45 \times 10^{23}$  molecules of  $\text{CH}_4$ ?10. How many moles are there in  $3.4 \times 10^{24}$  molecules of  $\text{NH}_3$ ?**Multi-Step Mixed Mole Conversions- Using the Factor Label Method and Moles Formula****Given unit  $\rightarrow$  Moles  $\rightarrow$  Desired unit**11. Find the mass in grams of  $2.00 \times 10^{23}$  molecules of  $\text{F}_2$ .

$$2.00 \times 10^{23} \cancel{\text{molecules}} \left( \frac{1 \text{ mole}}{6.02 \times 10^{23} \cancel{\text{particles}}} \right) = 0.332 \text{ moles } \text{F}_2$$

**Gram-formula-mass**  $\text{F}_2$  : F: 2 (19.0 g) = 38.0 g/mol; therefore 1 mole  $\text{F}_2$  = 38.0 g  $\text{F}_2$ 

$$\begin{aligned} \# \text{ of moles} &= \frac{\text{given mass}}{\text{gram formula mass}} & ; \text{ given mass} &= (\# \text{ of moles})(\text{gram formula mass}) \\ & & \text{given mass} &= (0.332 \text{ moles})(38.0 \text{ g } \text{F}_2) = 12.616 \text{ g } \text{F}_2 \end{aligned}$$

Name \_\_\_\_\_

Date \_\_\_\_\_

12. Find the mass, in grams, of  $1.00 \times 10^{23}$  molecules of  $\text{N}_2$ .

13. How many particles are there in 1.43 g of a compound with a gram formula mass of 233 g?

14. How many grams are there in  $3.4 \times 10^{24}$  molecules of  $\text{NH}_3$ ?

15. Aspartame is an artificial sweetener that is 160 times sweeter than sucrose (table sugar) when dissolved in water. It is marketed by G.D. Searle as *Nutra Sweet*. The molecular formula of aspartame is  $\text{C}_{14}\text{H}_{18}\text{N}_2\text{O}_5$ .

a) Calculate the gram-formula-mass of aspartame.

b) How many molecules are in 10 g of aspartame?

c) What is the mass in grams of 1.56 moles of aspartame?

d) How many atoms of nitrogen are in 1 mole of aspartame?