Mole Conversions Worksheet

There are three mole equalities. They are:

1 mol = 6.02×10^{23} particles
1 mol = g-formula-mass (periodic table) (GFM) or Molar Mass (MM)
1 mol = 22.4 L for a gas at STP

Mole-Particle Conversions

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

3.01×10^{22} atoms $\times \frac{1 \text{ mol}}{6.02 \text{E} 23 \text{ atoms}} =$ **0.0500 mol Mg**

2. How many molecules are there in 4.00 moles of glucose, $C_6H_{12}O_6$?

4.00 mol $\times \frac{6.02 \text{E} 23 \text{ m/c}}{1 \text{ mol}} =$ **2.41×10^{24} m/c $C_6H_{12}O_6$**

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

1.20×10^{25} atoms $\times \frac{1 \text{ mol}}{6.02 \text{E} 23 \text{ atoms}} =$ **19.9 mol P**

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

0.750 mol Zn $\times \frac{6.02 \times 10^{23}}{1 \text{ mol}} =$ **4.52×10^{23} atoms Zn**

5. How many molecules are in 0.400 moles of N_2O_5?

0.400 mol N_2O_5 $\times \frac{6.02 \text{E} 23 \text{ m/c}}{1 \text{ mol}} =$ **2.41×10^{23} m/c N_2O_5**

Mole-Mass Conversions

1. How many moles in 28 grams of CO_2 ?

28 g CO_2 $\times \frac{1 \text{ mol}}{44.009 \text{ g}} =$ **0.64 mol CO_2**

2. What is the mass of 5 moles of Fe_2O_3 ?

5 mol Fe_2O_3 $\times \frac{159.687 \text{ g}}{1 \text{ mol}} =$ **800 g Fe_2O_3**

3. Find the number of moles of argon in 452 g of argon.

$$452\ g\ Ar \times \frac{1\ mol}{39.948\ g} = \boxed{11.3\ mol\ Ar}$$

4. Find the grams in 1.26×10^{-4} mol of $HC_2H_3O_2$.

$$1.26 \times 10^{-4}\ mol\ HC_2H_3O_2 \times \frac{60.052\ g}{1\ mol} = \boxed{7.57 \times 10^{-3}\ g\ HC_2H_3O_2}$$

5. Find the mass in 2.6 mol of lithium bromide.

$$2.6\ mol\ LiBr \times \frac{86.845\ g}{1\ mol} = \boxed{230\ g\ LiBr}$$

Mole-Volume Conversions

1. Determine the volume, in liters, occupied by 0.030 moles of a gas at STP.

$$0.030\ mol \times \frac{22.4\ L}{1\ mol} = \boxed{0.67\ L\ gas}$$

2. How many moles of argon atoms are present in 11.2 L of argon gas at STP?

$$11.2\ L\ Ar \times \frac{1\ mol}{22.4\ L} = \boxed{0.500\ mol\ Ar}$$

3. What is the volume of 0.05 mol of neon gas at STP?

$$0.05\ mol\ Ne \times \frac{22.4\ L}{1\ mol} = \boxed{1\ L\ Ne}$$

4. What is the volume of 1.2 moles of water vapor at STP?

$$1.2\ mol\ H_2O \times \frac{22.4\ L}{1\ mol} = \boxed{27\ L\ H_2O}$$

Mixed Mole Conversions

1. How many oxygen molecules are in 3.36 L of oxygen gas at STP?

$$3.36\ L\ O_2 \times \frac{1\ mol}{22.4\ L} \times \frac{6.02 \times 10^{23}\ m/c}{1\ mol} = \boxed{9.03 \times 10^{22}\ m/c\ O_2}$$

2. Find the mass in grams of 2.00×10^{23} molecules of F_2.

$$2.00\times10^{23}\ m/c\ F_2 \times \frac{1\ mol}{6.02E23\ m/c} \times \frac{37.996\ g}{1\ mol} = \boxed{12.6\ g\ F_2}$$

3. Determine the volume in liters occupied by 14 g of nitrogen gas at STP.

$$14\ g\ N_2 \times \frac{1\ mol}{28.014\ g} \times \frac{22.4\ L}{1\ mol} = \boxed{11\ L\ N_2}$$

4. Find the mass, in grams, of 1.00×10^{23} molecules of N_2.

$$1.00\times10^{23}\ m/c\ N_2 \times \frac{1\ mol}{6.02\times10^{23}\ m/c} \times \frac{28.014\ g}{1\ mol} = \boxed{4.65\ g\ N_2}$$

5. How many particles are there in 1.43 g of a molecular compound with a gram molecular mass of 233 g/mol?

$$1.43\ g \times \frac{1\ mol}{233\ g} \times \frac{6.02E23\ m/c}{1\ mol} = \boxed{3.69\times10^{21}\ m/c}$$

6. 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 $C_{14}H_{18}N_2O_5$.

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

$$\boxed{294.307\ g/mol}$$

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

$$10\ g \times \frac{1\ mol}{294.307\ g} = \boxed{0.03\ mol\ aspartame}$$

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

$$1.56\ mol \times \frac{294.307\ g}{1\ mol} = \boxed{459\ g}$$

d) How many molecules are in 5 **mg** of aspartame?

$$5\ mg \times \frac{1\ g}{1000\ mg} \times \frac{1\ mol}{294.307\ g} \times \frac{6.02E23\ m/c}{1\ mol} = \boxed{1\times10^{19}\ m/c}$$

e) How many atoms of nitrogen are in 1.2 grams of aspartame?

$$1.2\ grams \times \frac{1\ mol}{294.307\ g} \times \frac{6.02E23\ m/c}{1\ mol} \times \frac{2\ atoms\ N}{1\ m/c} = \boxed{4.9\times10^{21}\ atoms\ N}$$