

5/1/13 Molar Relationships

Avogadro - 1 mole - Carbon-12: mass 12.00g of Carbon-12 it had 6.022×10^{23} atoms.

$$1 \text{ mole} = 6.022 \times 10^{23} \begin{matrix} \text{atoms} \\ \text{molecules} \\ \text{formula units} \end{matrix} = \text{molar mass in grams} = 22.4 \text{ L (for gases)} \\ \text{(from the periodic table)}$$

$$\underbrace{2.4 \text{ mol}}_{\text{given quantity}} \quad \underbrace{? \text{ atoms of carbon}}_{\text{need}} \quad \text{amt given} \times \frac{\text{label needed}}{\text{label given}}$$

$$2.4 \text{ mol} \left| \frac{6.022 \times 10^{23} \text{ atoms}}{1 \text{ mol}} \right| = \boxed{1.4 \times 10^{24} \text{ atoms}}$$

How many grams are in 12.6 L of Chlorine gas?

$$12.6 \text{ L Cl}_2 \times \frac{70.90 \text{ g}}{22.4 \text{ L}} = 39.9 \text{ g Cl}_2$$

H

⁷
N O F
Cl
Br
I

How many moles are in 4.23 g of magnesium?

$$4.23 \text{ g Mg} \times \frac{1 \text{ mol}}{24.31 \text{ g}} = 0.174 \text{ mol Mg}$$

Stoichiometry

- ① Balance reaction
- ② Determine molar ratio (use the coefficients in the reaction)
- ③ Set up Stoich. equation.

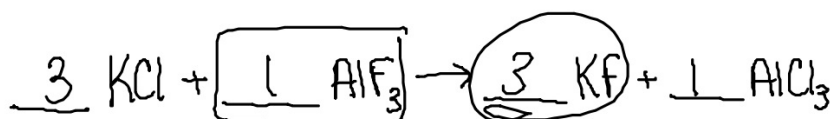
$$\text{given label} \times \frac{1 \text{ mol given}}{\text{molar mass given} \text{ -or- } 22.4 \text{ L}} \times \frac{\text{\# Coef. of mol need}}{\text{\# Coef. of mol given}} \times \frac{\text{molar mass of needed} \text{ -or- } 22.4 \text{ L}}{1 \text{ mol needed}} =$$

mol → mol	1 step = molar ratio	mass → mass	all 3 steps
mol → mass	2 steps = M.R. & last step	Vol → vol	all 3 steps
mass → mol	2 steps = 1 st step & MR		



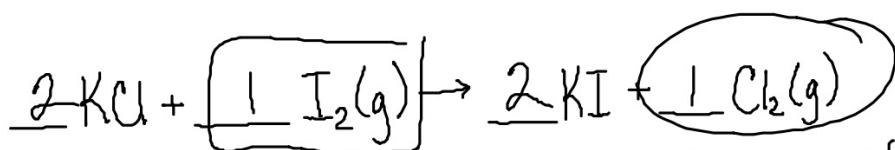
if $\underbrace{52.4 \text{ g of silver}}_{\text{given}}$ react how many $\underbrace{\text{moles of AgCl}}_{\text{need}}$ will be produced?

$$52.4 \text{ g Ag} \times \frac{1 \text{ mol Ag}}{107.87 \text{ g Ag}} \times \frac{\overset{\text{MR}}{\boxed{2 \text{ (mol AgCl)}}}}{2 \text{ mol Ag}} =$$



How many grams of potassium fluoride will be produced from 7.96g of AlF_3 ?

$$7.96 \text{ g AlF}_3 \times \frac{1 \text{ mol AlF}_3}{83.98 \text{ g AlF}_3} \times \frac{3 \text{ mol KF}}{1 \text{ mol AlF}_3} \times \frac{58.10 \text{ g KF}}{1 \text{ mol KF}} = \boxed{16.5 \text{ g KF}}$$



How many liters of chlorine gas will be produced from 56.4 L of I_2 ?

$$56.4 \text{ L I}_2 \times \frac{1 \text{ mol I}_2}{22.4 \text{ L I}_2} \times \frac{1 \text{ mol Cl}_2}{1 \text{ mol I}_2} \times \frac{22.4 \text{ L Cl}_2}{1 \text{ mol Cl}_2} = \boxed{56.4 \text{ L Cl}_2}$$

Molarity (liters) $M = \frac{n}{L} = \frac{\# \text{ mol of solute}}{\# \text{ L of solution}}$

if grams of solute \rightarrow moles

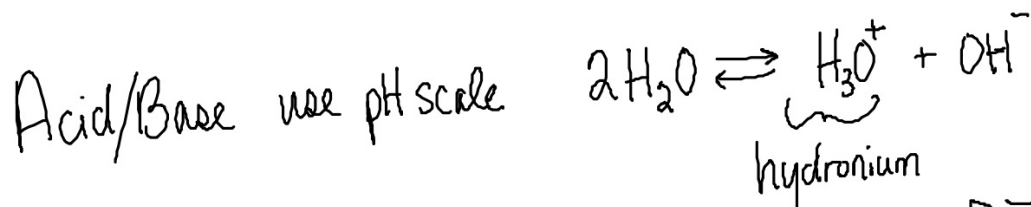
if given ml of solution \rightarrow L

molality (solid) $m = \frac{n}{\text{kg}} = \frac{\# \text{ mol solute}}{\# \text{ kg of solvent}}$

Small mass = solute \rightarrow moles

Large mass = solvent \rightarrow kilograms

grams given $\times \frac{1 \text{ mol}}{\text{molar mass}} = \# \text{ of moles}$



$\text{pH} = -\log [\text{H}_3\text{O}^+]$

$[\text{H}_3\text{O}^+] = 1.0 \times 10^{-9} \text{ M}$
 $\text{pH} = 9$

[] mean
Concentration of

$$[\text{H}_3\text{O}^+] = 1.5 \times 10^{-9} \text{ M} \quad \text{pH} = 8.8 \quad -\log(1.5 \times 10^{-9})$$

$$[\text{H}_3\text{O}^+][\text{OH}^-] = 1.0 \times 10^{-14} \text{ M} \quad \text{pH} + \text{pOH} = 14$$

$$\text{pOH} = 8 \quad ? \text{ pH} \quad \text{pH} = 6$$