Stoichiometry

Name: _____

Numerical conversions between different chemical quantities

Be able to perform the following interconversions for elements:

1. mole ⇔ number of particles2. mole ⇔ mass
3. # of particles ⇔ mass

Be able to perform the following interconverions for compounds:

1. mole (molecular mass and formula mass) ⇔ number of molecules or formula units or ions or atoms
2. mole ⇔ mass
3. # of molecules or formula units or ions ⇔ mass
4. Mole/mass/# of atoms or ion in a molecule or formula ⇔ one of the other quantity

Reaction Stoichiometry

Be able to interconvert between:

1. Mole of one reagent and mole of another
2. Mass of one reagent and mole of another
3. Mass of one reagent and mass of another
4. Number of particles of one reagent and mole of another
5. Number of particle of one reagent and mass of another reagent
6. Number of particles of one reagent and number of particles of another

General method for reaction stoichiometry:

1. Convert the given quantity (mass or number of molecules/formula units) of the substance to moles of the substance if it is something other than moles.
2. Convert moles of the substance to moles of the second substance.
3. Convert moles of the second substance to the quantity required (mass or number of molecules/formula units) if it is something other than moles.

And remember to follow the four-step approach to problems solving:

1. Define/Analyze the problem;
2. Determine an approach/plan;
3. Solve the problem—execute the plan; and
4. Check/evaluate the answer.

1. Mole Û Mole

$4K_{(s)} + O_{2\,(g)} \rightarrow 2K_2O_{(s)}$1a. If 0.25 moles of potassium were reacted with an excess amount of oxygen, how many moles of K_2O would be produced?

1b. If 0.35 moles of K_2O are produced, how many moles of oxygen gas was used up?

2. Mass Û Mole

2a. If 10.0 g of oxygen gas reacted with an excess amount of potassium, how many moles of K_2O would be produced?

2b. If 5.50 moles of oxygen gas reacted with an excess amount of potassium, how many grams of K_2O would have been produced?

3. Mass Û Mass

3. If 30.5 grams of K_2O were produced by a reaction between potassium and oxygen gas, how many grams of potassium would have been used up?

4. Number of particles Û Mole

4a. How many moles of oxygen are required to produce 1.20×10^{20} formula units of K_2O?

4b. How many oxygen molecules are required to react with 0.250 moles of potassium?

5. Number of particles Û Mass

5a. How many grams of oxygen are required to produce 6.02 X 10^{20} formula units of K_2O?

5b. How many oxygen molecules are required to react with 30.0 grams of potassium?

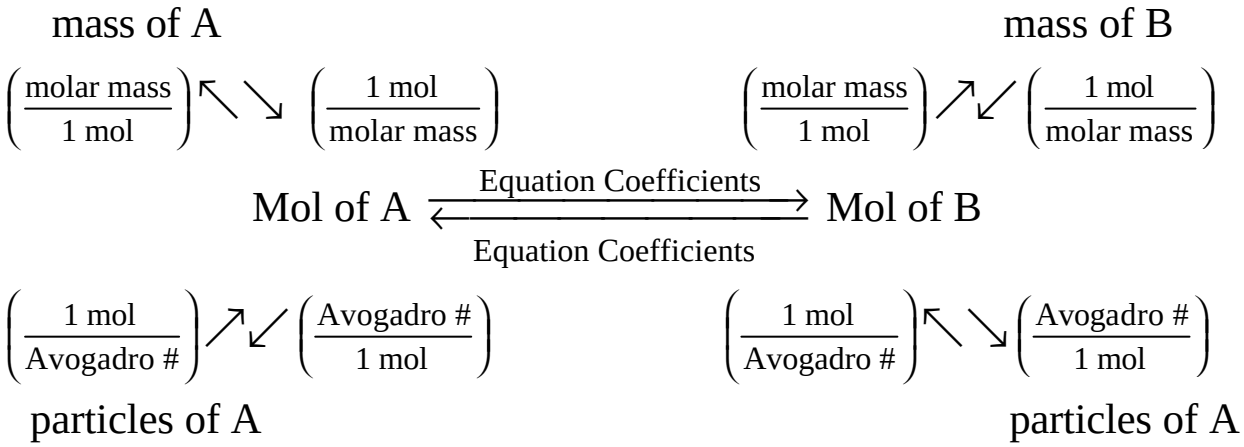
6. Number of particles Û Number of particles

6a. How many molecules of oxygen are required to produce 6.02 X 10^{20} formula units of K_2O?

6b. How many oxygen molecules are required to react with 1.2×10^{25} atoms of potassium?

Remember that the molar ratio given by the coefficients in a balanced chemical equation is the intermediate you go through to get the unknown from the given.

Summary



In every equation-based calculation, the intermediary is the ratio of coefficients in the balanced equation.

Conversion factor between mass and mole is the molar mass, while the conversion factor between particles and mole is the Avogadro's Number.