

PAL Worksheet- Chem 6A

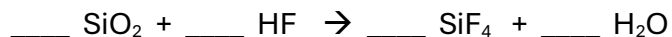
Reaction calculations

I. Mole rations in chemical reactions

In a written chemical reaction, what is listed on the *left* side of the reaction arrow and what does it represent?

In a written chemical reaction, what is listed on the *right* side of the reaction arrow and what does it represent?

Balance the following reaction with whole number coefficients:



Why do we balance reactions? What do the coefficients mean?

The coefficients in a reaction are also called **mole ratios**, or molar ratios. Write the mole ratio of HF to H₂O for the reaction above. Be sure to include the units, which are moles.

Write the mole ratio of H₂O to HF:

There are ten **more** mole ratios from this balanced reaction, using all of the reactants and products. Write them:

The mole ratios are used when performing calculations involving a reaction. The ratios compare one substance to another substance in a reaction. When setting up a calculation, the ratio is the link, or stepping stone, to connect units of one substance to the units of another substance. For example, using the reaction above, and only focusing on the units, if we start with units of *moles of H₂O*, we can calculate the *moles of HF*, using the mole ratio of these two substances:

$$\begin{array}{l} \text{moles H}_2\text{O} \times \frac{\text{moles HF}}{\text{moles H}_2\text{O}} \\ \cancel{\text{moles H}_2\text{O}} \times \frac{\text{moles HF}}{\cancel{\text{moles H}_2\text{O}}} = \text{moles HF} \end{array}$$

Notice how units of *moles of H₂O* cancel out, just like when we convert between units. This is the same concept. Keep in mind that in order for the moles to cancel out, the substance has to be the same. For example, *moles of H₂O* do *NOT* cancel out with *moles of HF*, as these units are *not* the same because they are moles of different substances.

Now you try: If 1.5 moles of H₂O are produced in the above reaction, how many moles of HF reacted? (Be sure to include the coefficients from the balanced reaction in your mole ratio.)

More Practice (using the same reaction above):

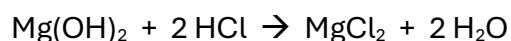
If 0.562 moles of SiO₂ were reacted in the above reaction, how many moles of SiF₄ were produced?

How many moles of HF are required to react with 2.2 moles of SiO₂?

II. Using grams in chemical reactions

In the lab, when carrying out a reaction, we will measure out the amount of reactants used, typically in grams for solids, or in mL for liquids; we can't weight out moles, for example. If a calculation is started with units of grams, rather than moles, can the amount of product still be calculated?

Use this balanced reaction to answer the following questions:



Fill in the missing units in order to correctly convert units of *grams of Mg(OH)₂* to units of *moles of H₂O*:

$$\text{grams Mg(OH)}_2 \times \frac{\text{moles Mg(OH)}_2}{\boxed{}} \times \frac{\boxed{}}{\text{moles Mg(OH)}_2} = \text{moles H}_2\text{O}$$

Circle and label the mole ratio above.

Did you also notice the ratio of *moles of Mg(OH)₂ / g Mg(OH)₂* ? Write the inverse of this ratio.

Have you seen this ratio before? What is it called?

How do you determine which numerical values to put in the numerator and denominator for this ratio?

Determine the molecular weight (molar mass) of Mg(OH)₂ :

Now try this: If 3.1 g of $\text{Mg}(\text{OH})_2$ reacted in the above reaction, how many moles of H_2O would be produced? (Hint: Use the same setup as above to convert the units, and be sure to include the values with each unit.)

Your answer above should be in units of moles. What should be done at this point to convert units of moles into units of grams for the product H_2O ?

Convert the *moles of H_2O* produced (above) into units of *grams of H_2O* .

Here's another reaction to use for the following set of questions:



Fill in the missing units in order to correctly convert units of *grams of KBr* to units of *moles of AlBr_3* :

$$\text{g KBr} \times \frac{\boxed{}}{\boxed{}} \times \frac{\boxed{}}{\text{moles KBr}} = \text{moles AlBr}_3$$

What is the mole ratio required to calculate the above conversion? Write the mole ratio needed (second ratio), including the numerical values. (What do you need to do with the reaction?)

Consider the first ratio above. What numerical values should be in the numerator and denominator of this ratio? (Hint: do you need to calculate something?)

Use the steps above to answer this question:

If 2.06 g of KBr were used in this reaction, how many moles of AlBr_3 would be produced?

How many grams of AlBr_3 would this be?

Use the same reaction to answer this question:

If 4.15 g of AlCl_3 were used in the reaction, how many grams of KCl would be produced?