Type 1: Finding the number of valence electrons

Step 1: Look on the periodic table for the electron configuration

Step 2: Determine the number of electrons in the last shell (the number furthest to the right).

Practice:

How many valence electrons do the following elements have?

1. Hydrogen
2. Lithium
3. Chlorine
4. Neon
5. Magnesium

Type 2: How to Write A Chemical Formula

Step 1: Use the periodic table to find the oxidation number (charge) of the element OR use the roman numeral to determine the charge OR use Table E to find the polyatomic

Step 2: Write the metal first and the nonmetal second and criss cross the charges to become the subscripts (the charge of the metal becomes the subscript of the nonmetal).

Step 3: Reduce the numbers (if applicable)

Practice:

What is the chemical formula if the following two atoms combine?

1. Lithium and chlorine
2. Oxygen and magnesium
3. Iron (II) and iodine
4. Nickel (III) and sulfur
5. Sulfate and Barium
6. Nitrate and Silver (I)

Type 3. Heat Equations

Step 1: Determine if the question is talking about heat during a temperature change or a phase change.

Step 2: Plug in variables and solve

Practice:

1. If the temperature of 34.4 g of ethanol increases from 25.0°C to 78.8°C, how much heat has been absorbed by the ethanol? (heat capacity: 2.46 J/(g*°C))

2. Approximately many joules of heat energy are released when 50 grams of water are cooled from 70°C to 60°C?
    1. 210 J
    2. 100 J
    3. 2,100 J
    4. 1,000 J

3. When 200 grams of water cools from 50.°C to 25°C, the total amount of heat energy released by the water is
    1. 210 J
    2. 21000 J
    3. 42000 J
    4. 1500 J

Type 4. Finding the Grams Formula Mass of a Chemical Formula

Step 1: Determine the elements in a chemical formula

Step 2: Determine the number of atoms of each element

Step 3: Multiply the number of atoms by the mass of each element

Step 4: Sum it up!

Practice:

1. Find the grams formula mass of potassium chlorate, $KClO_3$
2. Find the grams formula mass of barium nitrate, $Ba(NO_3)_2$
3. Find the grams formula mass of sodium sulfite, Na_2SO_3

Type 5. Percent Composition

Step 1: Find the grams formula mass of the compound

Step 2: Divide the total mass of each element by the molecular mass and then multiply by 100 to get percent composition.

Practice:

1. What is the percent composition of K and O in the compound K_2O?
2. What is the percent composition of oxygen in potassium chlorate ($KClO_3$)?
3. What is the percent composition of oxygen in glucose, $C_6H_{12}O_6$?

Type 6. Finding the Molecular Formula of a Compound

Step 1: Determine the mass of the empirical formula.
Step 2: Divide the formula of the compound by the mass of the empirical formula.
Step 3: Multiply the subscripts of the empirical formula by the answer you got in step 2.

Practice:

1. A compound has a molecular mass of 180 amu and an empirical formula of CH_2O. What is its molecular formula?
2. What is the molecular formula of a compound that has a molecular mass of 70 amu and has an empirical formula of CH_2?

Type 7. Determining if a chemical reaction will take place

Step 1: Determine which two elements are involved in the single replacement.
Step 2: Find which element is doing the replacing (the single element)
Step 3: Determine which element is being replaced (look at the compound and see which one is a single product)
Step 4: Look at your reference sheets and determine is the element in Step #2 is higher than the element in Step #3.
Step 5: If the element in Step #2 is higher, the reaction will take place!

Practice:

Example 1: Will this reaction take place? $Zn + Cu(NO_3)_2 \rightarrow Cu + Zn(NO_3)_2$
Example 2: $3Mg\ (s) + 2AlCl_3\ (aq) \rightarrow 2Al\ (s) + 3MgCl_2\ (aq)$
Example 3: $Br_2\ (g) + 2NaF\ (aq) \rightarrow 2NaBr\ (aq) + F_2\ (g)$

Type 8: Calculating number of moles in a reaction

Step 1. *Write the given (include units!).*
Step 2. *What are we looking for (include units!)*
Step 3. *What is the mole-to-mole ratio between the given and the compound we are looking for?*
Step 4: *List the given first and then multiply it by the ratio we found in step 3 so that the unit for what we want to know is the only factor left over.*

Practice

Example 1: Using the chemical equation below:

$$\mathbf{2\ Al + 3\ CuSO_4 \rightarrow Al_2(SO_4)_3 + 3\ Cu}$$

What is the number of moles of Al needed if 9 moles of Cu is produced?

Example 2: Using the chemical equation below:

$$4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$$

If 10 moles of Fe is used, how many moles of Fe_2O_3 is produced?

Example 3: Using the chemical equation below:

$N_2O_5 + H_2O \rightarrow 2HNO_3$

How many moles of HNO_3 is produced if 17 moles of H_2O is reacted?

Type 9: Converting between moles and grams

Step 1. *List the given. (Write units!)*
Step 2. *Determine what we need to find. (Write units!)*
Step 3. *Calculate the gram formula mass of the molecule that we are dealing with.*
Step 4. *Set up by listing the given first and multiply it the gram-formula mass we found in step 3 so that the unit for what we want to know is the only factor left over.*

Practice:

Example 1: What is the mass of 4.76 moles of Na_3PO_4 (gram-formula mass = 164 grams/mole)?
Example 2: What is the mass of 5.36 moles of H_2O?
Example 3: Determine the total number of moles of CH_3Br in 19 grams of CH_3Br (gram-formula mass = 95 grams/mol).

Type 10. Determining heat required for reactions given a chemical equation

Step 1. *Write the given (include units!).*
Step 2. *What are we looking for (include units!)*
Step 3. *What is the mole-to-energy ratio between the given and what we are looking for?*
Step 4: *List the given first and then multiply it by the ratio we found in step 3 so that the unit for what we want to know is the only factor left over.*

Practice:
Example 1: $2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g) + 392$ kJ
Determine the amount of heat released by the production of 1.0 mole of $SO_3(g)$.
Example #2: Given the equation: $2H_2(g) + O_2(g) \leftrightarrow 2H_2O(l) + 571.6$ kJ
Determine the amount of heat released by the production of 1 mole of H_2O.
Example #3: $C_3H_8(g) + 5O_2(g) \leftrightarrow 2CO_2(g) + 4H_2O(l) + 2219.2$kJ
Determine the total amount of energy released by the production of 1 mole of H_2O.