Chapter 7 Review Sheet
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Chemical Reactions: An Introduction

7.1: Evidence for a Chemical Reaction

Clues that a chemical reaction have occurred:

1. The color changes.
2. A solid forms.
3. Bubbles form.
4. Heat and/or a flame is produced, or heat is absorbed.
5. Water forms.

Examples of each:

1. when you put colorless hydrochloric acid + red solution of cobalt (II) nitrate together, the color changes from red to blue.
2. A solid forms when a solution of sodium dichromate is added to a solution of lead nitrate.
3. Bubbles of hydrogen gas form when calcium metal reacts with water.
4. Methane gas reacts with oxygen to produce a flame in a Bunsen burner.

7.2: Chemical Equations

- a chemical reaction involves a rearrangement in the way the atoms are grouped.
    - ex: $CH_4 + O_2 \rightarrow CO_2 + H_2O$

Structure of a chemical reaction formula:
Reactants-> Products

Reactants- the chemicals present before the reaction
Products- the chemicals formed by the reaction.
->: showing the direction of the change, = “yields” or “produces”

Rules for a chemical reaction:

- a chemical reaction involves changing the ways the atoms are grouped
- in a chemical reaction, atoms are never created nor destroyed.
- All atoms present in the reactants must be accounts for among the products.
- There must be the same number (#) of of each type of atom on the product side as on the reactant side of the arrow (->). * *balancing the equation* *

How to balance an equation:

$CH_4 + O_2 \rightarrow CO_2 + H_2O$

This equation is not balanced because it syas that one oxygen atom is created and two hydrogen atoms are destroyed (from the reactants to the products).

However, if you add another O_2 molecule on the left and put another molecule of H_2O on the right, the chemical equation would look like this:

$CH_4 + O_2 + O_2 \rightarrow CO_2 + H_2O + H_2O$

Now you can put the like terms together:

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

You can always have a checklist to see if the equation is balanced. For example, the final equation for this reaction would work out:

	Left side	Right side
C	1	1
H	4	4
O	2	2

What we learn from a chemical reaction:

1. The identities of the reactants and products.
2. The relative numbers of each.

Physical States:

Symbol	State
(s)	Solid
(l)	Liquid
(g)	Gas
(aq)	Dissolved in water (in aqueous solution)

Ex: solid potassium + liquid water-> hydrogen gas + potassium hydroxide. However, the potassium hydroxide remains dissolved in the water.

Now we can make the equation: $K(s) + H_2O(l) \rightarrow H_2(g) + KOH(aq)$

*** **Note: this reaction isn't balanced.** ***

7.3: Balancing Chemical Equations

Remember that:

- atoms are conserved in a chemical reaction
- The identities (formulas) of the compounds must never be changed in balancing a chemical equation.

This means that when balancing the reaction, you can only add in COEFFICIENTS.

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Coefficient- (in Mathematics): a numerical quantity placed before and multiplying the variable in an algebraic expression.

Sadly, trial and error seems like the best way to balance an equation.
For example: H_2 (g) + O_2 (g) -> H_2O (l)

The only way to fix this equation is to: **Add more molecules of reactants/products**.
Remember that:

- you can't change the formulas of the reactants or the products
- you can't create or destroy atoms.

Let's start by seeing how many of each molecule we have:

	Left side	Right side
H	2	2
O	2	1

Now let's try to even out the oxygen molecules by adding another molecule of H_2O (l) to the products (right side):

H_2 (g) + O_2 (g) -> $2H_2O$ (l)

	Left side	Right side
H	2	4
O	2	2

Now to even out the hydrogen molecules, you would simply add another H_2 (g) molecule to the reactants (left side).

$2H_2$ (g) + O_2 (g) -> $2H_2O$ (l)

	Left side	Right side
H	4	4
O	2	2

Now you have the balanced equation.

Let's say you did this problem and you ended up with:
$4H_2$ (g) + $2O_2$ (g) -> $4H_2O$ (l)
This is still a balanced equation, but note that you aren't in the simplest form. That you can just check to see if the whole equation's coefficients are divisible by a number.

$$\frac{4H_2\,(g) + 2O_2\,(g) \rightarrow 4H_2O\,(l)}{2}$$

as you can see, 2 is divisible into every part of the equation. Thus you would still end up with $2H_2\,(g) + O_2\,(g) \rightarrow 2H_2O\,(l)$ as your final answer. Note that the $O_2\,(g)$ has the coefficient of 1, even though you aren't supposed to show it.

How to balance and write equations:

Step 1: Read the description of the chemical reaction. What are the reactants, the products, and their states? Write the appropriate formulas?

Step 2: Write the *unbalanced* equation that summarizes the information from step 1.

Step 3: Balance the equation by inspection, starting with the most complicated molecule. Proceed element by element to determine what coefficients are necessary so that the same number of each type of atom appears on both the reactant side and the product side. Do not change the identities (formulas) of any of the reactants or products.

Step 4: Check to see that the coefficients used give the same number of each type of atom on both sides of the arrow. (Note that an "atom" may be present in an element, a compound, or an ion.) Also check to see that the coefficients use are the smallest integers that give the balanced equation. This can be done by determining whether all coefficients can be divided by the same integer to give a set of smaller integer coefficients.

Quick summary of chapter 7:

1. Chemical reactions usually give some kidn of visual signal- a color changes, a solid forms, bubbles form, heat and/or flame is produced.
2. A chemical equation represents a chemical reaction. Reactants are shown on the left side of an arrow and products on the right. In a chemical reaction, atoms are neither created for destroyed; they are merely rearranged. A balanced chemical equation gives the relative numbers of reactant and product molecules.
3. A chemical equation for a reaction can be balanced by using a systematic approach. First identify the reactants and products and write the formulas. Next write the unbalanced equation. Then balance by trial and error starting with the most complicated molecule(s). Finally, check to be sure the equation is balanced.