Learning Guide – Physical, Chemical, and Nuclear Changes 2
Chem 1010

Review

What type of change is occurring in the following situations?

whittling a stick of wood:

carbon-14 in a wooden artifact decaying to nitrogen-14

burning wood in a campfire:

What kind of change is taking place in each of the following equations? What does each represent?

$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$

$^{238}U \rightarrow {}^{234}Th + {}^{4}He$

$C_8H_9O_{(l)} \rightarrow C_8H_9O_{(g)}$

Types of Physical and Nuclear Reactions

There are two main types of physical changes that are commonly described by an equation in chemistry. What are they?

1)

2)

There are three common types of nuclear reactions. Where do each of these occur?

1) nuclear fusion – atoms joined together to make larger ones

2) Fission – large, unstable atoms are split apart

3) radioactive decay – a small piece of the nucleus of an atom is ejected

Label the following reactions as fusion, fission, or radioactive decay.

$^{236}U \rightarrow {}^{90}Sr + {}^{143}Xe + 3\ n^{o}$

$^{255}Fm \rightarrow {}^{251}Cf + {}^{4}He$

$^{209}Bi + {}^{64}Ni \rightarrow {}^{273}Rg$

<u>Clues that a chemical reaction is happening</u>

How can you recognize a chemical reaction if you have an equation?

$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$

If you don't know what the equation is, how can you tell?

What kind of clues?

Clue #1 – new compound forming that is a gas

example:

What gas is being formed?

$$CaCO_3 + 2\ HCl \rightarrow\ CaCl_2 + H_2O + CO_{2(g)}$$

Can you think of anything else that bubbles?

Clue #2 – new compound forming that is a solid

example:

What solid is being formed?

$$NaCl_{(aq)} + AgNO_{3(aq)} \rightarrow NaNO_{3(aq)} + AgCl_{(s)}$$

Can you think of anything else that forms a solid?

Clue #3 – new compound formed that is a different color

example:

What is the yellow solid?

$$KI + Pb(NO_3)_2 \rightarrow KNO_3 + PbI_2$$

Can you think of anything else that changes color?

Clue #4 – heat or light is released

example

What reaction is happening?

$$HCl + NaOH \rightarrow NaCl + H_2O + heat$$

Can you think of anything else that releases light or heat?

Now that you know the clues, you are ready to make some educated guesses about everyday processes. Which are chemical reactions, and which are not?

Rolls brown in the oven.

A red shirt fades in the sun.

Detergent washes grease off of pans.

Copper roof tiles turn greenish over time.

Cement dries and hardens.

Silver candlesticks tarnish.

Silver polish removes the tarnish.

One drop of food coloring turns the whole bowl of frosting red.

An acidic cleaner removes hard water deposits.

Food is digested.

Bleach removes a grass stain.

Hydrogen peroxide bubbles when poured on a cut.

A microwave heats a hot dog.

Candle wax melts.

A candle burns wax.

Meat turns brown when you cook it.

Plants make sugar and oxygen from carbon dioxide and water.

“Hot hands” get warm when bent.

Old wine turns into vinegar.

Paint remover loosens paint so it can be removed.

Balancing chemical reactions

When we write a chemical reaction, it is important to know how many units of each compound are needed.

hydrogen burning:

What are the reactants and products?

What are the formulas for these molecules?

What's wrong with this?

How do we fix it?

What does the new equation look like?

Why can't we just alter the formula?

In order to make sure that the equation works, make sure there are the same number of atoms of each element at the beginning and at the end of the reaction.

	Reactants		Products	
original equation: $H_2 + O_2 \rightarrow H_2O$				
new equation: $2\ H_2 + O_2 \rightarrow 2\ H_2O$				

antacid + stomach acid: $CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_{2(g)}$

Reactants					Products				

propane burning:

	Reactants		Products	
$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$				
$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$				
$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$				
$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$				

iron rusting: