Topics:

20:2 – The "Laws" of Chemical Reactions –
Principle of Definite Proportions – To make water you need 2 hydrogen and 1 oxygen atoms, no more – no less. Every compound exists in an exact formula in definite proportions.

Is Chemistry Magic or Science?

When a chemical reaction takes places sometimes the chemicals seem to "disappear". Of course they don't. So what happened to them? The chemicals have changed appearance or state of matter. If the products are gases it may seem as if they have disappeared, but they have just "transformed" into something invisible. Thus, the two following rules:

Principle of Conservation of Atoms – the number of atoms of each element in the reactant side must equal the number of atoms of each element in the product side. OR, Atoms are conserved in a chemical reaction.

Law of Conservation of Mass – mass is never created or destroyed it is just transformed.

Often it is hard to be certain that the mass (and atoms) in a reaction are conserved. Yet with a "closed system" we can prove just that. A closed system is one that "traps" the chemical reaction. The reason mass seems to disappear is that in open systems, some of the products may escape. The Earth is a closed system, but too big for us to investigate.

20:1 - Chemical versus Physical changes

Chemical Reactions –when chemical combine together (or just react to each other) and make new chemicals. When chemical changes occur, chemical reactions take place. Chemicals are changes and rearranged when chemical bonds are broken and new ones are formed.

Demos:

Physical changes: Salt water; sugar water; crinkling up paper; boiling of water; ice?

Chemical changes: burning wood; baking soda and vinegar;

Chemical change – a substance actually changes to something else.
Ex. – When wood burns it changes from wood to ash and smoke – it is no longer wood. Notice also the production of heat.

Evidence (Data) that a chemical change took place:

Bubbles – a new gas is formed (soda pop fizzling is not a chemical change, though. Why?)

Turns cloudy – a new solid is forming

Temperature changes – chemical bonds are breaking or forming

Color changes – a new substance is forming

NOTE: the next two are important, but BE CAREFUL some chemicals can be harmful or even fatal

Change in smell – new substance formed

Change in taste – new substance formed

(Your taste buds and nose are VERY sensitive and accurate chemical detectors.)

Physical change – a substance changes appearance, but it is this that substance.

Ex. – When water evaporates, it looks different, but it is still water.

Hard Example – Salt put into water to make salt water is only a physical change. How can you tell? 1) You can boil off the water to get the salt back; 2) if you taste it, it still tastes like salt.

Digestion – Processes involved: chewing; saliva (softening and lubricating and ?); stomach digestion (breaking down of food).

Chewing is a physical change – just making smaller food.

Saliva starts the chemical change of digestion. Enzymes in saliva start breaking down food, especially starches (like potato chips).

Stomach acids do most of the breaking down of food, which produces heat (proves it's a chemical change) and nutrients for the body. This heat produced is part of how we keep warm. More chemical changes occur in the intestines via addition chemicals.

"The Code": subscripts; superscripts; the arrow; coefficients

How to read a chemical reaction, the chemical equation:

A *subscript* (*sub*-below +*script*-writing: writing below the line) shows how many atoms (or ions) in a formula: in H_2O, the "2" says 2 atoms of hydrogen; in $Be(NO_3)_2$ the "2" means that there are 2 nitrate ions and a total of 1 Be, 2 N, and 6 O total.

A *superscript* (*super*-above +*script*-writing: writing above the line) shows the charge of an atom as in ion notation or for oxidation numbers: Na^{1+} - says sodium has a charge of positive one (has lost one electron).

A *coefficient* shows the number of molecules in a chemical reaction: $2H_2O$ means 2 water molecules and a total of 4 hydrogen and 2 oxygen atoms.

The arrow in a chemical equation says "produces" or "yields". You could also think of it as these "turn into" those. The arrow always point from the reactants to the products.

Reactants – the chemicals that are "reacting": what you are starting with.

Products – the chemicals that are "produced": what you end up with.

With this chemical reaction: $2H_2 + O_2 \; ? \; 2H_2O$

In English: 2 hydrogen molecules (4 atoms total) and 1 oxygen molecule (2 atoms total) make (or produce) 2 water molecules.

Why is the *coefficient* "2" in front of the hydrogen molecule?

Principle of Conservation of Mass -