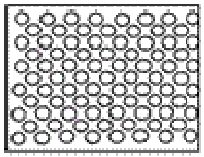
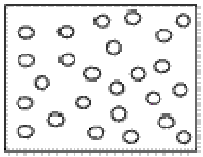
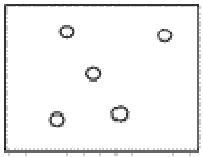
Chapter 12: Basics of Chemistry

Cosmetologists should study **chemistry because it gives you the ability to use professional products effectively and safely; helps you to know your products because they all have chemicals in them; lets you troubleshoot and solve common problems when doing chemical services.**

***Chemistry** *is the science that deals with the composition, structures, and properties of matter and how matter changes under different conditions.*

- **Organic chemistry-** the study of substances that contain carbon; materials that contain *both* carbon and hydrogen
- **Inorganic chemistry-** the study of substances that **do not** contain carbon but **do** contain hydrogen
- **Matter-** any substance that occupies space and has mass (weight); all matter is made up of chemicals (everything you can touch and see-with the exception of light and electricity- is matter)
- **Elements-** simplest form of chemical matter; there are 90 naturally occurring elements
- **Atoms-** (particles) the smallest chemical components of an element
- **Molecules-** a chemical combination of two or more atoms (for example, water is made of hydrogen and oxygen atoms)

Observable Properties of Matter: Solids, Liquids, and Gases		
Solids	**Liquids**	**Gases**
definite shape	no definite shape	no definite shape
definite volume	definite volume	no definite volume
may shatter	may splatter	may scatter
Atoms are bonded and vibrate less than the same matter in a liquid or gas state.	Atoms are not bonded and vibrate more than solids, but less than gases (for the same matter).	Atoms are not bonded and vibrate more than the same matter in a solid or liquid state
 solid particles	 liquid particles	 gas particles

States of Matter (p. 248)

solids: brush, rollers, clippers

liquids: bleach, shampoo, water

gas: propellant in hairspray, mousse

- **Physical properties**- determined without a chemical reaction: size, weight, hardness, glossiness
- **Chemical properties**- determined by a chemical reaction: wood burns, hair changes color through the use of dye or bleach

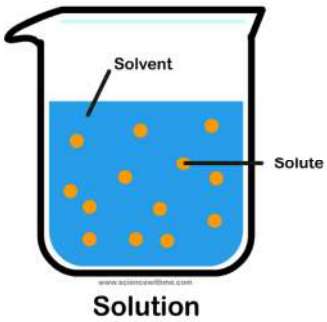
Physical Change and Chemical Change (p. 249-250)

- **Physical change-** a change in the form or physical properties of a substance without a chemical reaction or the creation of a new substance
  - When ice melts into water and then evaporates into a gas
  - When temporary haircolor is applied to the hair
  - When nail polish is taken off a nail *without a remover solvent*
- **Chemical change**- a change in the chemical composition or make-up of a substance
  - When grapes ferment and make wine
  - When wood burns and makes charcoal
  - When hair is bleached

Pure Substances and Physical Mixtures (p. 251-255)

- **Pure substance** - chemical combination of matter in definite proportions
  - Examples: atoms, elements, distilled water
  - Most substances do not exist in a pure state
- **Physical mixture** - physical combination of matter in any proportion
  - Examples: salt water, air

Solutions, Suspensions and Emulsions (p. 251-253)



Solution

solute- substance that is dissolved

solvent- substance that dissolves the solute

*ex: when you make salt water, salt is the **solute** and water is the **solvent***

- **Miscible-** liquids can be **mixed together** to form stable solutions; they do not separate when left still
- **Immiscible-** liquids are not capable of being mixed together; they separate when left together (ex: water and oil)

Solutions, suspensions, and emulsions are all physical mixtures.

- **Solution**- a stable physical mixture of two or more substances (ex: salt water)
- **Suspension**- an unstable physical mixture of undissolved particles in a liquid (glitter in nail polish; oil and vinegar salad dressing); must be shaken before using
- **Emulsion**- an unstable physical mixture of two or more immiscible substances (substances that do not normally stay blended) plus an emulsifier (which binds the substances together) (ex: hand lotion)

Common Chemical Product Ingredients (p. 255-256)

- **Volatile alcohols**- evaporate easily (ex: rubbing alcohol, hairspray)
- **Alkanolamines**- neutralize acids or raises pH; used in place of ammonia because they produce less odor
- **Ammonia**- colorless gas used to raise pH so solutions can penetrate hair shaft
- **Glycerin**- sweet, colorless, oily (used as a moisturizer in lotions)
- **Silicones**- special oil used in hair conditioners (less greasy than other oils)
- **Volatile organic compounds**-compounds that contain carbon and evaporate easily (found in hairspray, nail polish, polish removers)

<u>Potential Hydrogen (pH)</u> (p. 256-258)

Cosmetologists should understand pH and how it affects the hair, skin, and nails

- **pH** is the abbreviation for potential hydrogen; pH represents the quantity of hydrogen ions in a substance
- **ion-** an atom or molecule that carries an electrical charge
- **ionization-** the separation of atoms into positive and negative ions

pH Scale (p. 257)

ACIDIC NEUTRAL ALKALINE

A pH below 7 indicates an acidic solution.

A pH of 7 is neutral.

A pH above 7 indicates an alkaline solution.

Acids and Alkalis

- **Alpha hydroxyl acids**- also known as AHAs; derived from plants (mostly fruits); often used in salons to exfoliate skin and help adjust pH of lotions; acids contract and harden hair; an example is theoglycolic acid, a colorless liquid with a strong unpleasant odor used in perms
- **Alkalis**-also known as bases; have a pH above 7; feel slippery and soapy on the skin; they soften and swell hair, the cuticle on the nail plate, and calloused skin