Physical Properties

• Properties that describe the look or feel of a substance are called physical properties.
  – Examples: color, hardness, density, texture, phase.

• The physical properties can be used to identify a substance.

• The physical properties of a substance can change when conditions change, but that does not mean that a different substance is created.
Chemical Properties

• Are those that characterize the ability of a substance to react with other substances or to transform from one substance to another.
  – Examples: baking soda + vinegar = carbon dioxide + water + energy.

• Any change in a substance that involves a rearrangement of the way atoms are bonded is called a chemical change.
  – Examples: hydrogen + oxygen = water.
Determining Physical and Chemical Changes

- In a physical change, a change in appearance is the result of a new set of conditions imposed on the same material.
- Restoring the original conditions restores the original appearance.
  - Example: Ice to water.

- In a chemical change, a change in appearance is the result of the formation of a new material that has its own unique set of physical properties.
  - Example: Rust, baking soda + vinegar = carbon dioxide.
Ice melting: an example of physical change.
Potassium chromate changes color as temperature changes. The change in color is a physical change. A return to the original temperature restores the original bright yellow color.
A nail rusting: an example of chemical change.
When heated, orange ammonium dichromate undergoes a chemical change to ammonia, water vapor, and chromium (III) oxide. A return to the original temperature does not restore the orange color, because the ammonium dichromate is no longer there.
REVIEW QUESTIONS

• http://www.teacherbridge.org/public/bhs/teachers/Dana/chemphys.html
Classification of Matter

Matter

Heterogeneous Matter
- Mixtures

Homogeneous Matter
- Solutions
- Pure Substances
  - Compounds
  - Elements
Classification of Matter (cont.)

- According to make-up, matter exists as elements, compounds, mixtures, or solutions.
- Matter that has identical properties is called *homogeneous* matter.
  - Example: ice, water, iron, milk.
- Matter that has parts with different properties is called *heterogeneous* matter.
  - Example: salad, granite, soil, chocolate chip cookies.
Mixtures

• Matter that consists of two or more substances mixed together but not chemically combined.

• Each of the substances making up a mixture is a homogeneous substance.
  – Example: granite is a mixture of minerals quartz, mica, feldspar). Each mineral is homogeneous.
**Types of Mixtures**

- **Heterogeneous Mixture**
  - Mixture that does not appear to be the same throughout.
  - The particles are large enough to be seen and to separate them from the mixture.
  - Example: concrete, oil and vinegar.

- **Homogeneous mixture**
  - A mixture that appears to be the same throughout.
  - It is a “well mixed” mixture.
  - Example: stainless steel.
Solutions

• It is a type of homogeneous mixture formed when a substance dissolves in another.
• It is the “best mixed” of all mixtures.
  – Examples: antifreeze, ocean water, lemonade, iced tea.
• Properties
  – Particles in a solution are not large enough to be seen (for this reason most solutions cannot easily be separated by simple physical means).
  – Particles are evenly spread out (for this reason, all parts of a solution are identical).
  – Alloys: metal solutions.
  – Examples: gold jewelry, sterling silver, brass, stainless steel.
Elements

- Elements are the simplest pure substance.
- They cannot be broken down into simpler substances by heating or by any chemical process.
- The particles making up an element are in their simplest form.
  - Examples: iron, gold, oxygen, copper.
### Periodic Table of the Elements

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### Types of Elements Key
- Alkali metals
- Alkaline earth metals
- Transition metals
- Lanthanides
- Actinides
- Non-metals
- Noble gases
- Poor metals
- Semi-metals
- Semi-metals
The Periodic Table of the Elements, in Pictures
Elements and Atoms

- The smallest particle of an element that has the properties of that element is called the atom.
- All elements are made of atoms.
- An atom is the basic building block of matter.

Atoms of different elements are different.
Chemical Symbols

- Elements are represented by chemical symbols.
- Chemical symbols are a shorthand way of representing the element.
- Each symbol consists of one or two letters, usually taken from the element’s name.
Elements (cont.)

- Atomic number: 6
- Elemental symbol: C
- Element name: Carbon
- Atomic weight: 12.01
Compounds

- Pure substances that are made of more than one element.
- A compound is two or more elements chemically combined.
  - Examples: Carbon dioxide, ammonia, baking soda, and TNT.
- Unlike elements, compounds can be broken down into simpler substances like heating and electric energy.
- In general the properties of a compound are very different from the properties of the elements in it.
Compounds and Molecules

• Most compounds are made of molecules.
• A molecule is made of two or more atoms chemically bonded together.
• A molecule is the smallest particles of a compound that has all the properties of that compound.
• Just all atoms of a certain element are alike, all molecules of a compound are alike.
Examples of Molecules
Chemical Formulas

- Combinations of chemical symbols are called chemical formulas.
- Most chemical formulas represent compounds.
- Sometimes a formula represents a molecule of an element, not a compound.
- When writing a chemical formula, you use the symbol of each element in the compound.
- Subscripts are placed to the lower right of the symbols.
- A subscript gives the number of atoms of the element in the compound.
Chemical Equations

- The description of a chemical reaction using symbols and formulas is called a chemical equation.
- An equation is another example of a chemical shorthand.
- Instead of using words to describe a chemical reaction you can use a chemical equation.
- An equation can be balanced by placing the appropriate number in front of the chemical formula.
- This number is called a coefficient.

Reactants  Products
Chemical Equations

Examples:

• $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$

• $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$

Now balance the following equations:

• $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$

• $\text{NaCl} \rightarrow \text{Na} + \text{Cl}_2$
Identifying Elements, Compounds, and Mixtures

http://www.darvill.clara.net/hotpots/emc.htm
Answers

• 1. A, C, and D.
• 2. A and D.
• 3. C
• 4. E and F
• 5. H
• 6. G
• 7. B