

Unit 3: Compounds and Mixtures Benchmarks 8th Grade
Acids and Bases

Rate Yourself: **1-I am unclear about** **2- I have the basics down**
3- I know it, but need a little practice **4-I am an expert, I can teach it**

- 1. Differentiate between atoms, elements, and compounds
- 2. Explain how elements combine to form compounds that make up all living and nonliving things, for example:
 - o atoms share electrons to create a bond between them
- 3. Differentiate between pure substances, mixtures, and solutions, including:
 - o solutions are mixtures that may include multiple states of matter
- 4. Investigate different ways of making and separating mixtures and solutions, including:
 - o using a funnel and filter paper, a magnet, dissolving substances, screens, evaporation, etc.
- 5. Cite common examples of acids, bases, and salts
- 6. Investigate to classify various substances using the pH scale as an acid, base, or neutral

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Acids and Bases

1. Differentiate between atoms, elements, and compounds

***Atom** – the building block of all **matter**. It is the smallest piece of an element that still has the characteristics of that element. Atoms make up the elements listed on the periodic table. (Subatomic particles, protons, neutrons, and electrons make up all atoms, but alone, they do not have the same properties of a particular atom.) Example: one atom of He (helium), an atom of C (carbon), one atom of Na (sodium)

***Element** – An element is a pure substance that consists entirely of **one type of atom** and is found on the periodic table. An atom is the smallest amount of a particular element that can be identified as that element, and elements are pure substances. Example: Na, Li, K, Ca, Fe, & Cl

***Molecule** – Two or more atoms that are chemically bonded together; the elements can be the same or different, and they are pure substances. (Example: H₂O, water or O₂, oxygen gas)

***Compound** – A pure substance made of only 1 type of molecule all the way through, the molecule must be made up of at least two different types of atoms. It can be 1 molecule or many molecules of the same kind. (Example: 1 molecule of water OR a whole swimming pool full of water! Or NaCl, CO₂, KCl, H₂O₂)

Water (H₂O), Ammonia (NH₃), Carbon Dioxide (CO₂) and Salt (NaCl) are all molecules because they are made up of two or more atoms that are chemically combined. They are also compounds because they are made up of at least 2 different types of atoms that are chemically combined.

- Eggshells are made up of a calcium carbonate compound, and citric acid, which is found in oranges and other citrus fruit, is a compound of carbon, hydrogen, and oxygen atoms.

2. Explain how elements combine to form compounds that make up all living and nonliving things, for example:

*atoms can share electrons to create a bond between them

* atoms can transfer electrons to create a bond between them

* Elements primarily combine to form compounds through two main types of chemical bonding: ionic bonding and covalent bonding. A compound is any molecule that is made up of two or more different elemental atoms.

***ionic bonding** - metallic atoms typically have excess electrons in their outer orbitals, they tend to try and **transfer** electrons to nonmetals through a process called ionic bonding.

***covalent bonding** - Nonmetal elements are typically short electrons and will covalently bond to each other by **sharing electrons**.

3. Differentiate between pure substances, mixtures, and solutions, including: o solutions are mixtures that may include multiple states of matter

***Pure Substance** - a single kind of matter made of 1 type of atom (single atom or element), or 1 type of compound (single molecule or compound). All the elements on the periodic table are pure substances! Whether it's a single atom or compound or a collection of atoms, or compounds, it's a pure substance because it is the same all the way through. (Example: iron/Fe, helium/He, water/H₂O, Salt/NaCl, or gold.) Can't be separated with filter paper because it is all one type of matter....

***Mixture** – Two or more substances that are together in the same place, but they are not chemically bonded together. (Example: salt and pepper, trail mix, & salad.) Mixtures can be separated by physical means, e.g. filtration, evaporation, magnetic properties, distillation....

***Heterogeneous Mixture** – a mixture in which the separate parts can be seen easily and separated out. (Example: Cookies and Cream ice cream, oil & water, Trail mix, Lucky Charms cereal, an omelet made of scrambled eggs, mushrooms, and cheddar cheese, sand & water, salad.)

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***Homogeneous Mixture** – a mixture that is so evenly mixed that the separate parts cannot be seen. (Example: Kool Aid, Lemonade w/ no pulp, soda pop, or Tea)

***Solution** – A mixture in which one substance is dissolved into another – you can no longer see the separate parts. They are made with a **solvent (the largest part)**, and a **solute (the smaller part)**. For example in a solution of salt water, the water is the solvent and the salt is the solute. **(A solution is a homogeneous mixture.) (Example: let's use Kool Aid again, the water would be the solvent and the Kool Aid powder would be the solute. Lemonade, Coke, Tea)**

<u>Type of solution</u>	<u>Example</u>
Gas- Gas Mixture	Air
Solid – Liquid Mixture	Sugar water

4. Investigate different ways of making and separating mixtures and solutions, including: o using a funnel and filter paper, a magnet, dissolving substances, screens, evaporation, etc.

How do you separate a mixture of table salt and iron filings? Use a magnet to pull the iron filings from the salt

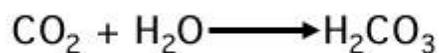
How would you separate a mixture of pebbles/water or sand/water? Pour them in a funnel with filter paper or a coffee filter

- Sort by observable properties such as size, shape, color
- Nets, screens, filters, sieve (strainer), colander
- Magnets
- Adding water. Ex: to separate sugar and sand, add water to dissolve sugar then use a filter to take out sand.
- Evaporation Ex: to separate sugar and water, evaporate the water

The substances that make up a mixture can be separated by physical means because they have different physical properties (such as different melting or boiling points) and are **not** chemically bonded. A mixture can be separated into its parts in a variety of ways, including letting the sand in a mixture of water and sand settle, and then draining off the water, *filtering*, and *evaporation*. You can use a funnel and coffee filter for filtration, and either use sunlight or low heat for evaporation. Evaporation will work for both saltwater and sand/water mixtures, but filtration will not work for saltwater. Lemon juice, a mixture of water and citric acid can be boiled. The water evaporates and eventually leaves nothing but citric acid crystals.

5. Cite common examples of acids, bases, and salts

1. When acids and bases combine they undergo a chemical change and produce a salt. The salts KCl (potassium chloride), LiCl (lithium chloride), NaCl (sodium chloride), and CaSO₄ (Calcium Sulphate) form by the **transferring of electrons** to produce a chemical bond between the atoms.
2. The hydrogen ions from carbonic acid give natural rain water a slightly acid pH value of 5.6 (Remember the closer the pH # is to 0, the stronger the acid). Over millions of years this very dilute acidic solution has been responsible for the formation of caves in areas of limestone rocks. CO₂ (carbon dioxide) in the air can dissolve in rain water to form a compound called carbonic acid, H₂CO₃.

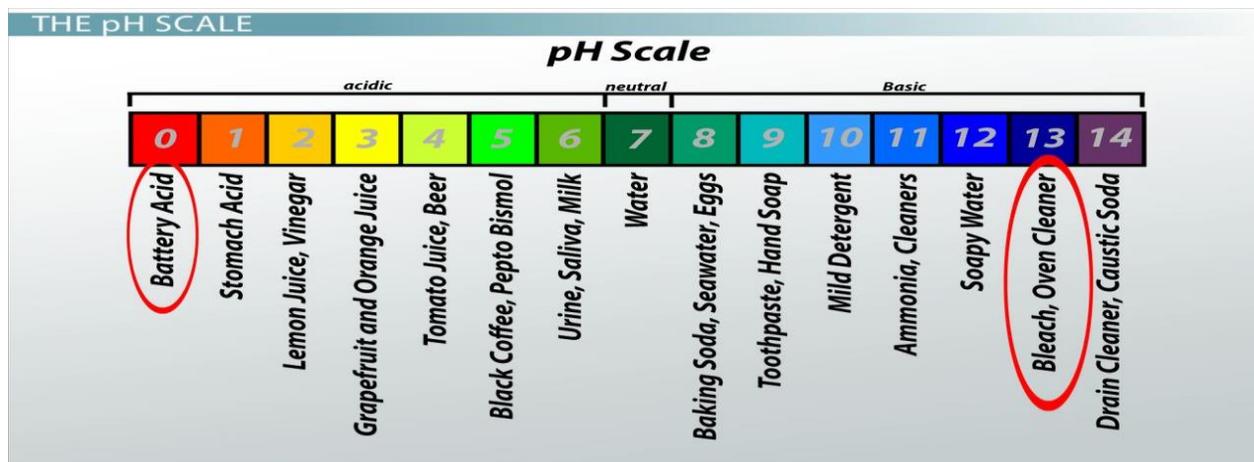


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3. The most common salt is sodium chloride (NaCl) or table salt which forms by the combination of sodium hydroxide (base) and hydrochloric acid. Other examples include Epsom salts (MgSO₄) used in bath salts, ammonium nitrate (NH₄NO₃) used as fertilizer, and baking soda (NaHCO₃) used in cooking.

6. Investigate to classify various substances using the pH scale as an acid, base, or neutral

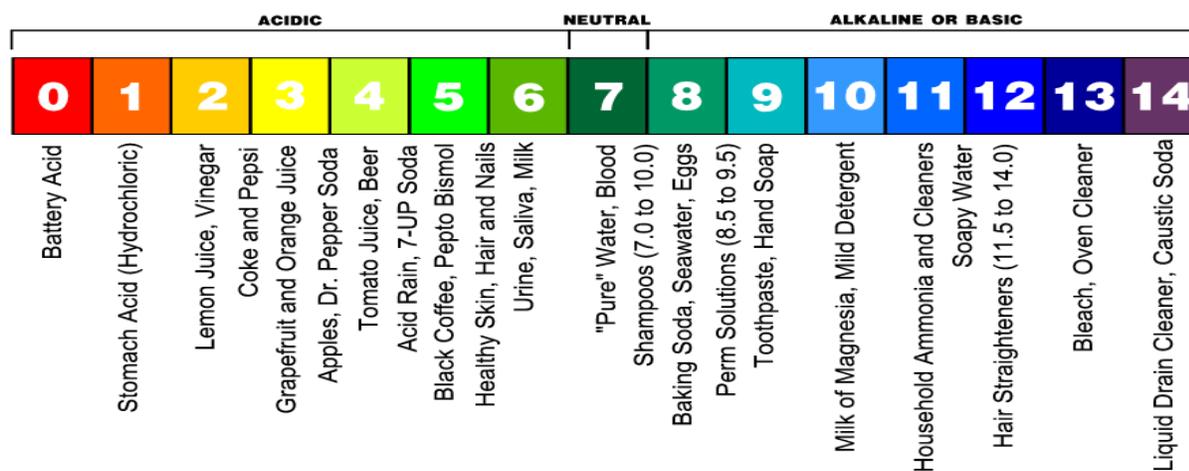
The pH scale measures how acidic or basic a substance is, and ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic. A pH greater than 7 is basic.



*** The lower the number the stronger the acid; the higher the number the stronger the base. Just ask yourself, how many whole lemons would you want to eat? ZERO! Lemons are an acid, and they are close to 0 on the pH scale.

*** Litmus paper, beet juice, and cabbage juice are common pH indicators that change color when they are exposed to acids and bases. pH paper will turn blue if the substance is a base, and red if the substance is an acid.

pH of Common Substances



***** Continue to study your Scientific Process "I Can" Statements!!!! Every summative will include questions on the scientific process.