

SCIENCE IDEAS CURRICULUM FRAMEWORK: CHEMISTRY (K-8)

Note: The following represents the results of a hierarchical conceptual analysis of Florida K-8 Big Ideas in Chemistry. In doing so, a perspective was adopted that represented the conceptual framework for chemistry in high school and introductory chemistry classes. Following this perspective, the core concepts and associated sub-concepts in chemistry were identified for grades K-8 in order to insure sound learning progressions from K-5 to 6-8. And, finally, this conceptual structure was applied and elaborated as necessary to provide Science IDEAS teachers with a grade-articulated curricular framework for chemistry instruction in grades K-5.

Core Concepts in Chemistry: Grade K-8 (Florida Standards- Big Ideas 8-9)

1. Matter takes up space and has mass
 - 1-1 Distinction between mass and weight.
2. Matter = an infinite number of combinations of a finite number of elements.
 - 2-1. Atoms are the smallest particles recognizable as a given element.
 - 2-2. Atoms are made up of even smaller parts (protons, neutrons, electrons, and others.) The combinations of those sub-atomic particles determine what kind of atom, or what element, it is.
 - 2-3. Elements are grouped in a periodic table so that elements with similar properties are next to each other.
 - 2-4. True metals are on the far left, transition metals (elements that have both metal-like and non metal like properties) are in the middle, non metals are on the right, gases are on the far right.
3. Physical properties can be observed or changed without changing the composition of an object (e.g. color, size, density, melting and boiling point, conductivity, solubility.)
 - 3-1. Plasma, gases, liquids, solids, phase changes.
 - 3-2. Pure substances, mixtures, solutions
 - 3-3. Density is a measure of how heavy a given volume of substance is. (“Which is heavier, a pound of rocks or a pound of feathers?”)
 - 3-4. Volumes of fluids can be measured directly; volumes of solids can be calculated or measured by displacement.
 - 3-5. Melting, boiling, evaporation, condensation, and dissolution are everyday examples of physical changes.
4. Chemical properties describe the composition and reactivity of an object (e.g. drain cleaner is mostly sodium hydroxide, or NaOH, and it breaks up grease.)
 - 4-1. In a chemical change a.k.a. chemical reaction, atoms are re-arranged into new combinations.
 - 4-2. Decay, digestion, burning, and rusting are everyday examples of chemical changes.
 - 4-3. Acids, bases, acid + base = salt + water, indicators.

- 4-4. Introduction to other functional groups (just as acids and bases predictably react to form salt and water, other specific combinations of atoms also react in predictable ways).

Core Concepts in Chemistry by Grade Level: K-8 (Florida Standards- Big Ideas 8-9)

Grade K

3. Everyday materials can be sorted by observable properties such as size, shape, color, temperature (hot or cold), weight (heavy or light), texture, hardness, density (sink or float), and magnetism = SC.K.P.8.1
3. Shapes of everyday materials can be changed without changing what the materials are = SC. K.P.9.1

Grade 1

1. All matter, including gases such as air, takes up space (added)
3. Everyday materials can be sorted and described by observable properties such as size, shape, color, temperature (hot or cold), weight, texture, hardness, density (sink or float), and magnetism = SC.1.P.8.1

Grade 2

3. Everyday materials can be categorized by observable properties such as size, shape, color, temperature, weight, texture, hardness, density (sink or float), and magnetism = SC.2.P.8.1
- 3-1 Identify everyday solids, liquids, and gases = SC.2.P.8.2
- 3-1 Recognize that solids have a definite shape and that liquids and gases take the shape of their container = SC.2.P.8.3
- 3-1 Observe and describe phase changes of everyday materials. = SC.2.P.8.4
- 3-4. Although they may seem different when poured back and forth between differently shaped containers, volumes of liquids don't actually change. = SC.2.P.8.6
- 3-5 Techniques for measuring temperatures of solids and liquids = SC.2.P.8.5
- 4-2 Decay, digestion, burning, and rusting are everyday examples of how some materials, but not others change into something completely different under the same conditions = SC.2.P.9.1

Grade 3

- 3-1 Describe the effect of temperature on phase changes and compare/contrast the physical properties of solids, liquids, and gases = SC.3.P.8.1 and SC.3.P.8.3
- 3-4. Techniques for measuring masses and volumes of solids and liquids =SC.3.P.8.2
- 3-5 Describe everyday phase changes using scientific terms such as melting, freezing, boiling, evaporation, and condensation =SC.3.P.9.1

Grade 4

- 3-2 Distinguish between mixtures of solids and/or liquids and/or gases and pure substances (added)
- 3-2 Components of a mixture of can be separated based on observable properties such as particle size or shape, color, magnetic attraction, density, or solubility in different liquids =SC.4.P.8.1
- 3-1 Describe the effect of temperature on phase changes and compare/contrast the physical properties of solids, liquids, and gases =SC.4.P.8.2
- 4-1 Combined mass of the parts = mass of the whole SC.4.P.8.3
- 3. Magnets can attract certain metals, but not other materials, and attract or repel other magnets depending on how the magnets are lined up SC.4.P.8.4
- 4-2 Decay, digestion, burning, and rusting are everyday examples of chemical changes because completely different materials are made =SC.4.P.9.1

Grade 5

- 2-1 All matter is made up of very tiny particles = SC.5.P.8.4
- 3-2 “Like dissolves like” and the effect of temperature on dissolution of gases and solids = SC.P.5.9.1, SC.5.P.8.2
- 3-2 Components of a mixture of can be separated based on observable properties such as particle size or shape, color, magnetic attraction, density, or solubility in different liquids =SC.5.P.8.3
- 3-3 Calculate and compare densities of liquids and solids through measurement of their masses and volumes (added)
- 3-3 Fluids and solids in them layer in the order of density starting with the densest at the bottom (added)
- 3-5 Describe everyday phase changes using scientific terms such as melting, freezing, boiling, evaporation, and condensation =SC.5.P.8.1

Grade 6

- 2 Matter = an infinite number of combinations of a finite number of elements (added)
- 2-1 Atoms are the smallest particles identifiable as a given element, but they are composed of even smaller subatomic particles (added).
- 2-2 Combinations of those sub-atomic particles determine what kind of atom, or what element, it is (added).
- 4 Chemical properties describe the composition and reactivity of an object (for example baking soda and vinegar are made up of specific combinations of atoms and they react with each other)(added)

Grade 7

- 2-2 Elements that have all of their subatomic particles are known as neutral and do not conduct electricity. Elements that lose some of their subatomic particles or gain extra ones conduct electricity and are more chemically reactive because they “want” to become neutral again (added).
- 2-3. Elements can be categorized by their properties (metals and nonmetals and solids, liquids, and gases at a given temperature) (added)
- 3 Some physical properties such as mass depend on the amount of material while others, such as boiling point, do not (added)
- 3 Some changes (e.g. cooking, burning, rusting, decay) result in completely new materials being made while other (e.g. phase changes) do not (added).
- 3-1 Plasma is a gas that lost some of their subatomic particles and conducts electricity (added)

Grade 8

- 1 Mass (but not density) is conserved throughout physical and chemical changes =SC.8.P.9.1
- 1-1 Distinction between mass and weight =SC.8.P.8.2
- 2-1 Atoms are the smallest particles recognizable as a given element, but they are composed of even smaller subatomic particles (electrons surrounding a nucleus containing protons and neutrons.) =SC.8.P.8.7
- 2-1 Properties of solids, liquids, and gases can be explained by the motion of their particles =SC.8.P.8.1

- 2-2 Atoms are made up of even smaller parts (protons, neutrons, electrons, and others.) The combinations of those sub-atomic particles determine what kind of atom, or what element, it is =SC.8.P.8.7
- 2-3 Elements are grouped in a periodic table so that elements with similar properties are next to each other =SC.8.P.8.5
- 2-4 True metals are on the far left, transition metals (elements that have both metal-like and non metal-like properties) are in the middle, non metals are on the right, gases are on the far right =SC.8.P.8.6
- 3 Measurable physical properties that are intrinsic (do not depend on the amount of sample, only on the type of material) include density, thermal and electrical conductivity, solubility, magnetic properties, and melting and boiling points =SC.8.P.8.4
- 3 Physical changes, such as phase changes or dividing a whole into parts, do not involve a change of chemical composition (types of atoms and how they are arranged) and are usually reversible =SC.8.P.9.2
- 3-2 Distinguish between mixtures of solids and/or liquids and/or gases and pure substances =SC.8.P.8.9
- 3-3 Calculate and compare densities of various materials through measurement of their masses and volumes using metric units =SC.8.P.8.3
- 4-1 In a chemical change a.k.a. chemical reaction, atoms are re-arranged into new combinations and those changes are usually irreversible =SC.8.P.9.2
- 4-1 Many chemical changes are affected by temperature and pressure =SC.8.P.9.3
- 4-3 Acids, bases, acid + base = salt + water, indicators =SC.8.P.8.8
- 4-4 Introduction to other functional groups (just as acids and bases predictably react to form salt and water, other specific combinations of atoms also react in predictable ways) (added).