

## Chemistry Topics Lists

### 1. Matter: Mass, Volume, and Density Topics List (1-1, 1-2)

The tangible (able to be sensed) universe consists of matter and energy. Examples of energy include movement, sound, visible and invisible light, and stored or potential energy.

Two objects may not occupy the same space at the same time.

Volume is an amount of three-dimensional space.

Fluid (liquid or gas) volume is customarily measured with liters, milliliters, etc., while solid volume is customarily measured with cubic length units such as cubic centimeters (cc's) or cubic meters. Liquid volume is measured with a graduated cylinder. One cubic centimeter is equal in volume to one milliliter.

Matter may be thought of as "stuff," and has mass and volume.

The volume of regular objects may be calculated with measurements and formulas while the volume of irregular objects may be calculated using the water displacement method.

The volume of a cube may be calculated by multiplying lengthxwidthxheight. You need to be able to calculate the volume of a cube given its dimensions.

Mass is the amount of matter in an object and doesn't change unless matter is added to or taken away from the object. Weight is the force of gravity pulling on an object and will change if mass or gravity changes.

A spring scale is used to measure weight while a balance is used to measure mass.

Weight units are newtons while mass units are grams, kilograms, etc.

Density is the relationship between an object's mass and volume, or how "heavy" an object is for its size.

Low density: Styrofoam, balsa wood, most gases/ High density: Lead, steel, granite

Water has a density of 1 g/ml.

Density controls buoyancy(floating). A less dense object will float in a more dense fluid. A more dense object will sink in a less dense fluid. An object whose density is equal to the density of the fluid it is in will suspend or hang in the middle of the fluid neither sinking nor floating.

Mathematically:  $\text{Density} = \text{Mass} / \text{Volume}$  (density equals mass divided by volume)

Be able to use it to calculate the density of an object give its mass and volume.

**Matter: Mass, Volume, and Density Study Guide**

What is matter? \_\_\_\_\_

What is mass? \_\_\_\_\_

How is mass measured? \_\_\_\_\_

What is the SI unit label for mass? \_\_\_\_\_

Are mass and weight the same? \_\_\_\_\_ If not, what is the difference? \_\_\_\_\_

What is weight? \_\_\_\_\_

What is the SI unit label for weight? \_\_\_\_\_

How is weight measured? \_\_\_\_\_

What is volume? \_\_\_\_\_

Everything in the universe that you can see is made up of some type of \_\_\_\_\_.

How is the volume of a liquid measured? \_\_\_\_\_

How is the volume of a regular shaped solid measured? \_\_\_\_\_

How is the volume of an irregular solid measured? \_\_\_\_\_

What two SI (metric) unit labels are used for volume? \_\_\_\_\_

What is density? \_\_\_\_\_

What is the formula to calculate density? \_\_\_\_\_

What is the unit label for density? \_\_\_\_\_

1 ml equals \_\_\_\_\_  $\text{cm}^3$

If something is more dense than water, and you place it in water, what will it do? \_\_\_\_\_

If something is more less dense than water, and you place it in water, what will it do? \_\_\_\_\_

The density of water is \_\_\_\_\_

## 2. Physical, Chemical, and States of Matter Topics List(1-2, 1-3,2-1)

Know and be able to describe the 6 physical properties pictured on page 11 of the textbook.

Be able to classify properties as physical or chemical.

Be able to classify changes as physical or chemical.

Physical changes change the shape or form of the object or material without changing it into a new substance while chemical changes change the identity of one or more substances so that a new substance is formed.

Physical properties are those properties that can be observed without making new substances. Examples include state, density, color, and hardness. Chemical properties describe the ability of a substance to change into another substance or substances. Chemical properties may only be observed by changing or trying to change the substance into a new substance.

Recognize the signs of chemical change shown and described on pages 18-19 of the textbook.

A characteristic property is a physical or chemical property that does not depend on the quantity (mass or volume) of the substance—useful in identifying and classifying substances. (p.17)

Be able to describe solids, liquids, and gases in terms of their volume and shape. Be able to identify examples of the different states.

Be able to describe solids, liquids, and gases in terms of the spacing and speed of their particles.

States of matter are determined by a balance of forces among the particles. The particles' energies (temperature) cause them to move around and spread apart while the attractive forces among particles cause them to stick together. How these forces balance out determines the state of matter.

	Solid	Liquid	Gas
Particle spacing	very close together	almost as close as solid	spread out
Particle speed	slowest	medium	very fast
Particle interaction	particles locked in place, vibrating	Particles stay together but slide past one another to change locations	Particles touch/interact very little
Balance of forces	Attraction among molecules overwhelms particle energy	Attractive and particle energy are somewhat balanced	Particle energy overwhelms attraction among molecules
Volume	definite	definite	Indefinite—may be compressed or expanded
Shape	definite	Indefinite—takes the shape of the container	Indefinite—takes the shape of the container

### 3. Atoms Topics List(CH4)

State Standard: Describe the structure of the atom and its component parts.

1. Scientific theories change over time to explain new data.
2. Models are useful for understanding the natural world, but they can be misleading.
3. The atom is composed mostly of empty space.
4. Matter in the atom is protons, neutrons, and electrons.
5. Protons are dense positively charged particles in the nucleus.
6. Neutrons are dense uncharged particles in the nucleus.
7. Electrons are much smaller negatively charged particles that whirl around the nucleus as bees whirl around a hive.
8. An atom is identified as an element by the number of protons.
9. Ion: when an atom has a more or fewer electrons than protons. More electrons gives it a negative charge while fewer electrons gives it a positive charge.
10. Isotope: atoms of a substance that have different numbers of neutrons, and therefore, different mass numbers/atomic masses.
11. Gravity is a force that draws all matter to all other matter. Its strength depends on mass and distance.
12. Electromagnetic force is the force that attracts protons to electrons and repels protons from protons and repels electrons from electrons. The terms positive and negative are used to describe the charges, and it is the force that causes electricity and magnetism.
13. Strong force is the force that holds nuclear particles together.

Particle	Charge	Location	Mass
Proton	+ (positive)	nucleus	1 amu
Neutron	0 (uncharged)	nucleus	1 amu
Electron	- (negative)	Orbit/cloud outside nucleus	0 amu (very much less than 1 amu)

#### 4. Elements and the Periodic Table Topics List (CH 3 sec 1, CH 5 sec 1)

P.106-113&56-59

##### Table of Common Elements and their Properties

\* denotes elements explicitly mentioned in the state standards.

Element	Symbol	Class	State	Physical prop	Chemical prop
Oxygen*	O	Nonmetal	Gas	Colorless, odorless	Reactive, causes combustion
Hydrogen*	H	Nonmetal	Gas	Low density, colorless, odorless	Highly reactive
Nitrogen	N	Nonmetal	Gas	Colorless, odorless	Less reactive than oxygen or hydrogen
Helium	He	Nonmetal	Gas	Low density, colorless, odorless	Non-reactive noble gas
Chlorine	Cl	Nonmetal	Gas	Green, strong odor	Highly reactive with hydrogen and metals, poisonous
Carbon*	C	Nonmetal	Solid	Varied:diamond, hard, shiny, clear, crystalline Graphite: soft, black	Reactive with oxygen, important in the compounds found in living things
Iron*	Fe	Metal	Solid	Moderate/high density, dull silver color, hard	Reacts with oxygen to form rust
Aluminum*	Al	Metal	Solid	Low density, dull silver color, softer than iron	Less reactive than iron and many other metals
Lead	Pb	Metal	Solid	High density, dull silver color, very soft	Poisonous, combines easily with oxygen

Element: a pure substance that cannot be broken down chemically into simpler substances.

Metals: Mostly solids, shiny, good conductors, malleable and ductile

Metalloids/Semimetals: Some shiny, some dull, somewhat malleable and ductile, some are good conductors, some semiconductors

Nonmetals: Solids are dull, brittle, and poor conductors; gases are nonmetals

Pure substance: Made up of only one type of particle; includes elements and compounds

Elements are pure substances because each is made up of only one kind of atom.

Characteristic property: may be used to identify a substance; doesn't depend on quantity of the sample

The periodic table is organized in the following way:

- Atomic number: each element goes up by one proton as you move across a period.
- Periods: Horizontal rows; properties such as reactivity and conductivity change gradually as you move across a period, so period neighbors have similar properties
- Groups: Vertical columns; elements have similar chemical or physical properties to their group neighbors (elements in the same column)

Be able to use a periodic table to identify the elements in a compound by their symbols.

Be able to use the periodic table to locate metals, semimetals/metalloids, and nonmetals:

Metals are left and middle, non metals are in the top right corner, and metalloids are between metals and non-metals.

## 5. Compounds and Mixtures Topics List (CH 3 sec 2,3)

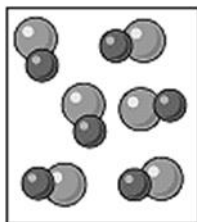
### Compounds

The properties of compounds are usually very different from the properties of the elements that make them up.

Atoms of elements bond together to form molecules of compounds. The bonding happens so that atoms may share electrons to fill their outer shells (create a stable electron configuration).

A compound, like an element, is a pure substance.

Be able to analyze the chemical formula of a compound to tell how many atoms of each element it contains.  $C_6H_{12}O_6$  contains 6 carbons, 12 hydrogens, and 6 oxygens, 24 atoms total.



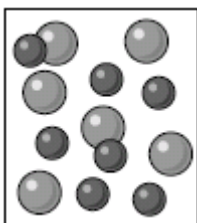
### Mixtures

Be able to contrast a mixture with a compound (p.66 table 1)

Mixture: Made of elements, compounds, or both; the substances keep their properties; may be separated by physical means, formed by any ratio of substances

Compound: Made of elements; substances change their properties; may only be separated by chemical means; formed by a set ratio of substances

Be able to classify mixtures as solutions, colloids, or suspensions using their properties (see table below).



<b>Solution</b>	<b>Colloid</b>	<b>Suspension</b>
Smallest particles, molecules/atoms/ions	Larger particles but still very small	Largest particles
<i>Appears</i> uniform like a pure substance. Doesn't scatter light (not cloudy)	Scatters light. Cloudy.	Scatters light. Cloudy.
Particles too small to settle out.	Particles too small to settle out.	Particles settle out.
Cannot be filtered	Cannot be filtered	Can be filtered
Saltwater, sugar syrup, steel, carbonated water	Jello, milk, mayonnaise	Snow globe, muddy water, anything that you have to shake before using.

Be able to explain how physical means, such as boiling/evaporating, sifting/filtering, magnetism, density, hand sorting, and solubility, may be used to separate mixtures. (p 65).

Know the definition of solvent, solute, solubility, and concentration.

Know the factors that affect how solids and gases dissolve in liquid solvents: heating/cooling, crushing, stirring, mixing. (p. 69)