Matter: Mass, Volume, and Density Topics List

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. One cubic centimeter is equal in volume to one milliliter.

Matter may be thought of as "stuff."

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 length x width x height. 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.

The density formula is D = M/V. Be able to use it to calculate the density of an object give its mass and volume.

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.

Physical, Chemical, and States of Matter Topics List

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.

	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

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.

Compounds and Mixtures Study Guide

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 create a stable electron configuration.
- A compound, like an element, is a pure substance.

Mixtures

- Be able to contrast a mixture with a compound (p.66 table 1)
- Be able to classify mixtures as solutions, colloids, or suspensions using their properties.
- 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.
- Know the definition of solvent, solute, solubility, and concentration.
- Know examples of different states of solutions (p.67 table 2)
- Know the factors that affect how solids and gases dissolve in liquid solvents: heating/cooling, crushing, stirring, mixing.

Solution	**Colloid**	**Suspension**
Smallest particles, molecules/atoms/ions	Larger particles but still very small	Largest particles
Appears 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.

When the solvent is a liquid…
heating increases the solubility of solids and decreases the solubility of gases
cooling increases the solubility of gases and decreases the solubility of solids

Ways to speed dissolving a solid dissolving in a liquid: stirring, heating, crushing
Which one is the solvent?
If there is only one liquid in a solution, then that liquid is the solvent.
If there are no liquids, or if there are two or more liquids in a solution, then the substance present in the greatest amounts is the solvent.

Atoms and Elements Study Guide
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

Know the definition of element.
Know the three major categories of elements and their properties(conductor/semi-conductor, insulator, malleable/brittle, shiny/not shiny.
Know that elements are pure substances and why.
Know the definition of characteristic property.
Know the patterns by which the periodic table is organized:

- --Periods(horizontal rows)
- --Groups(vertical columns)
- --Atomic number(#protons)

Be able to use a periodic table to identify the elements in a compound.
Be able to use the periodic table to locate metals, semimetals/metalloids, and nonmetals.