**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.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | 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 |

**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.

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.

Atoms Topics List (chapter 4, section 2)

1. Scientific theories change over time to explain new data.
2. The atom is composed mostly of empty space.
3. Matter in the atom is protons, neutrons, and electrons.
4. Protons are dense positively charged particles in the nucleus.
5. Neutrons are dense uncharged particles in the nucleus.
6. Electrons are much smaller negatively charged particles that whirl around the nucleus as bees whirl around a hive.
7. An atom is identified as an element by the number of protons.
8. Gravity is a force that draws all matter to all other matter.  Its strength depends on mass and distance.
9. 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.
10. Strong force is the force that holds nuclear particles together.
11. Isotopes are atoms of one type of element that have different numbers of neutrons.

**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**

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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.