

Chemistry Concepts for OAKS test

Matter: all the substances that make up everything in the universe that have mass and takes up space/has volume

Mass: The amount of matter in an object measured in grams, kilograms on a balance. Mass does not depend on gravity

Weight: The force of gravity acting on an object

Volume: The amount of space and object or substance takes up. Measured in cm^3 or milliliters ml. $1 \text{ cm}^3 = 1 \text{ ml}$

Volume of a *regular* shaped object like a cube or rectangular solid is = length X width X height

Volume of an *irregular shaped* object can be determined by water displacement. Place the object in a certain volume of water and let the water rise to see how much water the object displaces or moves out of the way

Density: The amount of mass in a certain volume, calculated by dividing mass by volume. For example a 100 gram piece of gold with a volume of 5 cm^3 . Would have a density of 20 g/cm^3 or 20 grams per cubic centimeter. That is very dense. The density of air is about $.001 \text{ g/cm}^3$. The density of water is 1 g/ml or 1 g/cm^3 . Another unit for density could be grams/milliliter or g/ml or grams per milliliter.

Pure substances: elements and compounds have distinct properties or characteristic properties. One of these is density. For example the density of copper is 8.9 g/cm^3 no matter how big a piece of copper you have. Another characteristic of them is solubility (see below) or color, hardness, shininess. A characteristic property is not dependent on how much of a substance there is. It is true of all pieces of that pure substance

Elements: are pure substances made up of one type of atom. The elements can be found on a table called the periodic table of elements. Examples of a elements are gold, aluminum, oxygen, nitrogen, neon, zinc

Atoms: are the smallest piece of an element that has all the properties of the element. All atoms are made up of sub atomic particles called protons, neutrons and electrons. Protons and neutrons are found in the nucleus of the atom and give the atom it's mass and the electrons are found in an electron cloud around the nucleus.

Periodic Table of elements: Is an organizational table for the elements. They are arranged in order of atomic number going across in horizontal rows. The atomic number is the number of protons in the nucleus. The columns on the periodic table are called families. The columns to the far left are some of the most reactive elements (alkali metals and alkaline earth metals) and the second to last column to the right also contains some very reactive elements (halogens). The far right column

is made up of gases that do not tend to react with other elements (noble gases). About 2/3 of all elements are metals and they are found on the left side of the periodic table. The right hand side contains the non-metals.

Compounds: are pure substances made up of more than one type of atom/element and the atoms are chemically bonded together. Examples of compounds are water (H₂O) Carbon Dioxide (CO₂) and Salt or sodium Chloride NaCl.

Mixtures: most substances are mixtures of pure substances. These are sometimes well mixed like salt water or not very well mixed like a fruit salad

Solutions: are a special type of well mixed mixture where one substance, a *solute* *dissolves* in another substance a *solvent* to form a *homogeneous* (same throughout) mixture. An example would be sugar dissolved in water or oxygen dissolved in water.

Solubility: is a measure of how much (in grams) of a solute can dissolve into a certain volume of a solvent

Effect of temperature on matter:

Matter **expands** when heated meaning its volume increases but the mass stays the same. This causes the density to decrease. The decreased density is what causes hot air or hot water to rise above cooler air or water.

Matter **contracts** when cooled and so the density increases. There is the same amount of matter or mass in a smaller volume. This causes cooler air to sink. (An exception is water, which expands when frozen because air gets trapped in between water molecules. Ice is less dense than water and it floats)

Conservation of Mass: Mass is conserved or stays the same during physical and chemical changes in a closed system. For example if you melt an ice cube the mass of the solid ice will be the same as the mass of the liquid water as long as you do not allow any of it to evaporate

Phases of matter or States of matter: solids, liquids and gases
Matter can change phase when heat energy is added or removed.

Melting: when matter changes from a solid to a liquid

Evaporation: when matter changes from a liquid to a gas

Condensation: when matter changes from a gas to a liquid

Freezing: when matter changes from a liquid to a solid

Changes to Matter:

Physical Changes: changes like dissolving and phase changes do not alter the types of atoms and how they are arranged in the matter. Dissolving is just a well mixed mixture, phase changes increase or decrease the spacing of the particles, but not the properties of the substance. Some other examples of physical change might be changing the shape of something like a piece of clay or cutting a piece of paper. It is still the same type of matter

Chemical Changes: During a chemical change, the arrangement of atoms changes and new substances are formed. Evidence that a chemical change has taken place is that there are new substances that were not there before or that substances have disappeared. Some examples of chemical change are burning, a cold pack that becomes cold when two parts are mixed. Rusting of iron, when a silver metal turns into reddish iron oxide because the iron atoms have combined with oxygen atoms in the air. Electrolysis/splitting of water using electricity when the hydrogen and oxygen atoms are separated and you end up with two gases hydrogen and oxygen instead of liquid water.