Chemistry Notes

Day Two

Summer 2011

1 States of matter

Chemistry studies matter in its various states. The three states we will consider are solid, liquid, and gas. Solids have fixed shape and volume; liquids have fixed volume but variable shape; and gases have variable shape and variable volume.

2 Physical and chemical properties and changes

Physical properties are properties inherent to a substance, while chemical properties involve a substances ability to form new substances.

2.1 Examples

Property	Type
Boiling point of water	Physical
Hardness of diamond	Physical
Fermentation of sugar to form alcohol	Chemical
Metal wire conducting electricity	Physical
Metal melting	Physical
Paper combusting in air	Chemical

3 Elements and compounds

Elements are a single type of atom. All of the entries on the periodic table (e.g. oxygen, hydrogen, and iron) are elements. Compounds are specific combinations of multiple different elements. H_{20} , $C_6H_{12}O_6$, and NaCl are all compounds.

3.1 Examples

Example	Type
Water (H ₂ O)	Compound
Nitrogen (N)	Element
Glucose $(C_6H_{12}O_6)$	Compound

4 Mixtures

Mixtures have variable composition, while pure substances are made up of the same substance throughout. Pure substances are always elements or compounds. Homogeneous mixtures (AKA solutions) are the same throughout, while heterogeneous mixtures differ throughout.

4.1 Examples

Example	Type
Gasoline	Homogeneous mixture
Copper	Pure substance
Air	Homogeneous mixture
Salt water	Homogeneous mixture
A stream with gravel at the bottom	Heterogeneous mixture

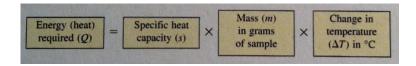
5 Energy and specific heat

Energy is different than matter. It is not solid, liquid, or gas. Rather, it is the capacity to do work. Energy can be measured in either joules or calories, with:

1 cal = 4.184 J

To find the specific heat of an object, we use the formula:

$$Q = s \times m \times \Delta T$$



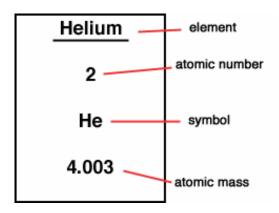
6 Atomic theory

The atom is composed of a tiny nucleus at its center with electrons orbiting around the outside. The nucleus is composed of protons and neutrons.

Particle	Relative charge
Proton	+1
Neutron	0
Electron	-1

7 The periodic table

The periodic table contains every element now known to us. It can be used to determine the electron configuration of atoms (see attached figures) and the relative atomic radius of elements. Remember, atomic radius increases from top to bottom, and decreases from left to right.



8 Isotopes and allotropes

Isotopes are different forms of the same element, with different numbers of neutrons. Carbon-12 and carbon-14 are different isotopes of carbon, for example. Allotropes, on the other hand, are different structural forms of an element. Each atom remains unchanged in different allotropes, but the way the atoms are bonded together changes. Graphite and diamond are different allotropes of carbon, for instance.

9 Ions

Ions are charged atoms, represented by a plus or a minus sign following the atom's symbol. For instance, a calcium atom that gives up two electrons becomes a Ca_2^+ ion, while a chlorine atom that gains an electron becomes a Cl^- ion.

10 Acknowledgements

Some information Zumdahl's Introductory Chemistry: A Foundation.