

Atoms and elements

- ✓ **Nucleus:** protons (+) and neutrons (no charge); over 99% of the mass
- ✓ **Electrons (-)** form a cloud around it
- ✓ **Atomic number:** the number of protons; oxygen's is 8
- ✓ **Mass number:** protons + neutrons; $8 + 8 = 16$ for most oxygen
- ✓ **Element:** atoms that all have the same number of protons
- ✓ **Periodic table:** every element, in order of protons and grouped by chemical properties

Ions and isotopes

- ✓ **Ion:** an atom whose protons and electrons do not balance
- ✓ **Cation:** more protons, a positive ion; **anion:** more electrons, a negative ion
- ✓ **Isotopes:** the same element with different numbers of neutrons: carbon-12, -13 and -14 have 6, 7 and 8
- ✓ Too many or too few neutrons makes an isotope **unstable**: it breaks down by **radioactive decay** (carbon-14)

States of matter

- ✓ **Solid:** fixed shape and volume; particles vibrate in place
- ✓ **Liquid:** fixed volume, but takes its container's shape; particles slide past one another
- ✓ **Gas:** no fixed shape or volume; fills its container; particles far apart and fast
- ✓ **Plasma:** gas so hot its electrons break free; stars, lightning, neon lights; most of the universe's matter
- ✓ **Physical change**, such as freezing, keeps the same substance

Temperature

- ✓ How fast the particles move, on average
- ✓ Water freezes at $0^{\circ}\text{C} = 32^{\circ}\text{F}$ and boils at $100^{\circ}\text{C} = 212^{\circ}\text{F}$
- ✓ $F = C \times \frac{9}{5} + 32$ and $C = (F - 32) \times \frac{5}{9}$
- ✓ $20^{\circ}\text{C} = 20 \times \frac{9}{5} + 32 = 68^{\circ}\text{F}$

Bonds and reactions

- ✓ **Ionic bond:** one atom gives electrons to another, and the opposite charges attract; usually a metal and a nonmetal
- ✓ **Covalent bond:** atoms share electrons; usually two nonmetals
- ✓ **Chemical reaction:** reactants become new substances, the products: burning wood, baking, digestion
- ✓ Atoms are neither made nor destroyed, so equations balance: $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ (photosynthesis)

Solutions

- ✓ A mixture so blended its parts cannot be seen apart: air, salt water, coffee
- ✓ **Solvent:** the larger part (most often water); **solute:** the smaller part
- ✓ **Solubility:** the most of a substance a solvent can dissolve

Acids and bases

- ✓ **pH scale:** 0 to 14; **7 is neutral**, like water
- ✓ **Acid:** pH below 7; forms hydrogen ions (H^+); sour, corrosive: stomach acid, lemon juice
- ✓ **Base:** pH above 7; forms hydroxide ions (OH^-); bitter, slippery: soap, bleach