Chemical Reactions - Extent and Speed

Consider the reactions when we dissolved baking soda $NaHCO_3$, washing soda Na_2CO_3, and chalk $CaCO_3$ in water and when we added vinegar, (6-7% acetic acid in water) to them.

Solubility of $NaHCO_3$ in water: dissolved, but not quickly up to a maximum of 9 g/100 mL
Solubility of Na_2CO_3 in water: dissolved quickly up to a maximum of 21.5g/100 mL
Solubility of $CaCO_3$ in water: did not dissolve noticeably, but did up to a maximum of 0.0013g/100 mL

Reaction of $NaHCO_3$ with vinegar: yes, violently, foamed up with released CO_2 gas
Reaction of Na_2CO_3 with vinegar: yes, bubbles of CO_2 gas formed
Reaction of $CaCO_3$ with vinegar: yes, but extremely slowly, helps if $CaCO_3$ is ground to a fine powder

Mixture of H_2 and O_2 gases at room temperature and no spark: essentially no reaction
Mixture of H_2 and O_2 gases with spark: explosive reaction

Diamond at room temperature: changes to carbon so slowly it appears stable

Chemical reactions can go either way depending on the temperature (energy), entropy (concentration) differences:

Explosions provide their own extra energy to raise the temperature and speed up their reaction.

Combustion proceeds at a speed dependent on oxygen availability and temperature.

Reactions with aqueous reactants and products go both ways, reaching an equilibrium point.

Aqueous reactions that release gas bubbles or form an insoluble solid go to completion.

Lower temperatures slow reactions. Freezing slows food spoilage.

Sea shells dissolve when Ca^{++} and/or CO_3^{--} are removed from the surrounding water. (When additional CO_2 from the atmosphere is dissolved in water, the subsequent reactions reduce the CO_3^{--} concentration.)

Lower threshold energy speeds reactions. Enzymes greatly speed up biological reactions.

Electricity can direct oxidation-reduction reactions like electrolysis of water or electroplating.

Oxidation-reduction reactions can produce electricity.