3.1

Chemical reactions alter arrangements of atoms

* Atoms interact in chemical reactions
	+ **Chemical reaction**: produces new substances by changing the way in which atoms are arranged.
		- Bonds between atoms are broken and new bonds form between different atoms
		- A new substance is formed
	+ Physical changes
		- Change in the state of a substances
		- Same substance as original substances, may be some slightly different properties
	+ Chemical Changes
		- New substance is produced
		- Breaking apart original substance, or adding to the original substance
	+ Reactants and Products
		- **Reactants**: substances present at the beginning of a chemical reaction
		- **Products**: substances formed by a chemical reaction
		- Reactants and products can be elements or compounds depending on the reaction
	+ Evidence of Chemical Reactions
		- Color Change
		- Formation of Precipitate
			* Precipitate: solid product from a chemical reaction
		- Formation of a Gas
		- Temperature Change
* Chemical reactions can be classified
	+ **Synthesis**: a new compound is formed by the combination of simpler reactants
	+ **Decomposition**: a reactant breaks down into simpler products, which could be elements or other compounds
	+ **Combustion**: one reactant is always oxygen and another reactant often contains carbon and hydrogen
* The rates of chemical reactions can vary
	+ Most chemical reactions take place when particles of reactants collide with enough force to react
	+ Three physical factors and a chemical factor can greatly affect the rate of a chemical reaction
		- Physical Factors
			* **Concentration**: measures the number of particles present in a certain volume
				+ High concentration of reactants means there is a large number of particles that can collide and react.
			* **Surface Area**: area of the surface of the reactant
				+ Breaking large piece of material into smaller parts increases the surface area of the material and the rate of reaction
			* **Temperature**: increasing temperature increases molecular motion which increases the number of collisions and the rate of reaction
		- Chemical Factor
			* **Catalyst**: a substance that increases the rate of a chemical reaction but is not itself consumed in the reaction
				+ After the reaction, the catalyst remains unchanged

3.2

The masses of reactants and products are equal

* Careful observations led to the discovery of conservation of mass
	+ 1780s French chemist Antoine Lavoisier showed that matter can never be created or destroyed in a chemical reaction
	+ Law of Conservation of Mass: in a chemical reaction, atoms are neither created nor destroyed. All atoms present in the reactants are also present in the products
* Chemical reactions can be described by chemical equations
	+ Total mass of reactants is equal to the total mass of products
	+ Chemical equations represent how atoms are rearranged in a chemical reaction
		- Reactants on the left
		- Products on the right
	+ To write a chemical equation you need:
		- Reactants and the products in the reaction
		- The atomic symbols and chemical formulas of the reactants and products in the reaction
		- The direction of the reaction
* Chemical equations must be balanced
	+ You can balance a chemical equation by changing the amounts of reactants or products represented
	+ Using Coefficients to balance equations
		- Coefficients: the numbers in front of the chemical formulas, indicate how many molecules take part in the reaction.
			* If there is no coefficient, there is only one molecule of that type
		- Only a coefficient can be changed in order to balance a chemical equation

3.3

 Chemical reactions involve energy changes

* Chemical reactions release or absorb energy
	+ Chemical reactions involve breaking bonds in reactants and forming new bonds in products.
	+ Breaking bonds requires energy, forming bonds releases energy
	+ **Exothermic reaction**: a reaction in which energy is released
	+ **Endothermic reaction**: a reaction in which energy is absorbed
* Exothermic reactions release energy
	+ Often produce an increase in temperature
	+ Bond energies of the reactants are less than the bond energies of the products
	+ Excess energy can be released as light or heat energy
* Endothermic reactions absorb energy
	+ Often produce a decrease in temperature
	+ All endothermic reactions absorb energy, but do not all absorb energy as heat
	+ **Photosynthesis**: plants absorb energy from sunlight to turn carbon dioxide and water into glucose and oxygen
* Exothermic and endothermic reactions work together to supply energy
	+ Exothermic Reaction
		- Reactants 🡪 products + energy
	+ Endothermic Reaction
		- Reactants + energy 🡪 Products

3.4

 Life and industry depend on chemical reactions

* Living things require chemical reactions
	+ Respiration: how living cells obtain energy from glucose molecules
		- Requires the “combustion” of glucose to obtain this energy
	+ To increase rates of reactions, body uses chemical catalysts called enzymes for each step
* Chemical reactions are used in technology
	+ Driving a car – combustion reaction
	+ No chemical reaction is completely efficient
		- Some reactants don’t change completely into products
		- Sometimes unwanted waste products are produced
* Industry uses chemical reactions to make useful products
	+ **Electronics industry** – semiconductor used to precisely control the conduction of electrical signals