**Exercise – Factors Affecting Reaction Rate**

1. In general, what effect does an increase in the concentration of the reactants have on the rate of the reaction? (explain using the collision theory)
2. How do changes each of the following factors affect the rate of a chemical reaction? Use diagrams to clarify your explanations.
3. Temperature
4. particle size
5. pressure

3. Which equation of the following pairs of equations would occur the fastest at under the same conditions. Explain your answers.

1. i) Zn2+(aq) + S2–(aq) → ZnS(s)
ii) Zn(s) + S(s) → ZnS(s)
2. i) 2 H2O2(aq) → 2 H2O(l) + O2(l)
ii) Cu(s) + 2 AgNO3(aq) → 2 Ag+(aq) + Cu(NO3)2(aq)
3. i) Pb(NO3)2(aq) + 2 KI(aq) → PbI2(aq) + 2 KNO3(aq)
ii) C3H8(g) + 5 O2(g) → 3 CO2(g) + 4 H2O(g)
4. i) 2 Fe(s) + 3 O2(g) → 2 Fe2O3(s)
ii) 2 NO(g) + O2(g) → 2 NO2(g)

**Answer Key**

1.

* Increasing the concentration of reactants, increases the number of particles in the container.
* An increase in the total number of particles increases the number of particles with kinetic energy greater than or equal to activation energy.
* More particles with activation energy means more frequent effective collisions.
* More effective collisions results in an increased reaction rate.
* Increasing the number of particles in a container reduces the spaces between the particles.
* Smaller spaces between the particles results in a greater probability of collisions occurring therefore increased frequency of collisions.

2. a)

* Increasing temperature, increases the rate of most reactions
* Decreasing the temperature will decrease the rate.
* Increasing the temperature, increases the kinetic energy of all the particles, shifting the kinetic energy distribution curve to the right(T3 in the figure below).
* More particles have activation energy, therefore increased reaction rate
* Decreasing temperature, decreases kinetic energy of all particles (T1 in figure below)
* Less particles with activation energy, therefore lower rate.



2. b)

* Changing particle size is only effective for heterogeneous and solid reactants.
* Grinding the reactants increases number of reactant particles in contact.
* Increased particles in contact, increases frequency of collisions and reaction rate.

c)

* Pressure changes only affect gaseous reactants.
* Increasing pressure reduces space between particles, increasing probability of collisions.
* Increased probability of collisions, increases frequency and rate.
* Decreasing pressure, increases spaces between particles.
* Decreasing pressure decreases frequency of collisions and, therefore, rate.

3.

1. The reaction Zn2+(aq) + S2–(aq) → ZnS(s) is faster, since the reactants are all aqueous. The reactants in reaction (ii) are solids. Solid reactants react slowest.
2. The reaction Cu(s) + 2 AgNO3(aq) → 2 Ag+(aq) + Cu(NO3)2(aq) is the fastest. This reaction involves the transfer of electrons from Cu to Ag+, while the other involves the breaking of covalent bonds.
3. The reaction Pb(NO3)2(aq) + 2 KI(aq) → PbI2(aq) + 2 KNO3(aq) is faster. Reactions with aqueous reactants are almost instantaneous. The other reaction involved the breaking of many covalent bonds.
4. 2 NO(g) + O2(g) → 2 NO2(g) is a homogeneous reaction of gaseous reactants, while the reaction 2 Fe(s) + 3 O2(g) → 2 Fe2O3(s) is bewteen heterogeneous reactants. (Consider how slowly iron rusts)