THE SCIENCE SCRIBE: MASTERY GUIDES

REACTIVITY & EQUILIBRIUM

FOR LEVEL TWO CHEMISTRY

REACTION RATES

COLLISION THEORY:
States that for a chemical reaction to occur the reactant particles must collide with sufficient energy. A reaction is fast if there are many successful collisions per second. There are four factors which can affect the rate of reaction: changing the concentration, temperature, surface area and using a catalyst.

CONCENTRATION:
Describes how many particles there are per unit volume. Dilute is the opposite of concentrated.

If something has a high concentration it has many particles per unit volume.

TEMPERATURE:
Indicates how much kinetic energy particles have and how fast they are moving.

If something has a high temperature then it means particles have a lot of kinetic energy and move very fast.

SURFACE AREA:
Indicates how many particles are exposed and available at the start of a reaction.

If something has a high surface area then it means there are many reactant particles exposed and many reactant particles available at the start of the reaction.

CATALYST:
Provides an alternative pathway for a reaction to occur. The alternative pathway will have a lower activation energy.

A lower activation energy means less energy is required for a collision to be successful.

WRITING FRAMES

CONCENTRATION (E.G INCREASING CONC. OF HCl, REACTING WITH Mg)

If the concentration of **HCl** is **increased** then this will **increase** the rate of reaction. This is because **increasing** the concentration of **HCl** will **increase** the number of **HCl** particles per unit volume; this means there will be **more** collisions between **HCl** and **Mg** reactant particles per second and hence **more** successful collisions per second so the rate of reaction **increases.**

TEMPERATURE (E.G INCREASING TEMP. OF H_2SO_4 REACTING WITH NaOH)

If the temperature of H_2SO_4 is **increased** then this will **increase** the rate of reaction. This is because **increasing** the temperature of H_2SO_4 will **increase** the average kinetic energy and speed of the H_2SO_4 particles. An **increase** in the speed of the H_2SO_4 particles will mean that there are **more** collisions between the H_2SO_4 and **NaOH** particles per second. In addition to that, an **increase** in the average kinetic energy of H_2SO_4 particles will mean that **more** particles will have enough energy to overcome the energy barrier when they collide; this means the number of successful collisions occurring per second **increases** so the rate of reaction **increases**.

SURFACE AREA (E.G INCREASING SURF. AREA OF $CaCO_3$ IN HCl)

If the surface area of $CaCO_3$ is **increased** then this will **increase** the rate of reaction. This is because **increasing** the surface area will increase the number of $CaCO_3$ particles exposed to **HCl**. This means that there will be **more** $CaCO_3$ particles available at the start of the reaction so that there will be **more** collisions between $CaCO_3$ **and HCl** particles per second and hence **more** successful collisions per second; therefore the rate of reaction **increases**.

CATALYST

If a catalyst is included then this will **increase** the rate of reaction. This is because including a catalyst will provide an alternate pathway of lower activation energy. This means that less energy is required for a collision to be successful therefore more reactant particles will have enough energy to overcome the energy barrier

WRITING FRAME KEY POINTS

All the writing frames above cover the following points:
- States whether the rate of reaction is increased/decreased.
- Mentions keywords: collisions occurring per second, and collisions being successful.
-- Identifies which of the four factors are being discussed and the consequences these factors have in terms of particles.