IB Chemistry HL Notes

Reaction Kinetics

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Reaction Kinetics

Date No.

$$\text{Speed} = \frac{\text{Distance}}{\text{time}}$$

$$\text{Rate of reaction} = \frac{[\text{product}]}{\text{time}} \text{ or } -\frac{[\text{reactant}]}{\text{time}}$$

- [products] ↑, [reactants] ↓

$$HCl_{(aq)} + CaCO_{3(s)} \rightarrow CaCl_{(aq)} + CO_{2(g)}\uparrow + H_2O_{(l)}$$

- Can record volume of CO_2 evolved
- Can record decrease in mass of system as gas is released.

$$2HCl_{(aq)} + Na_2S_2O_3 \rightarrow 2NaCl_{(s)} + SO_{2(g)} + S_{(s)}\downarrow + H_2O_{(l)}$$

- S is precipitated, → colour change as yellow S is ppted.
- Can vary $[Na_2S_2O_3]$ to detect reaction rate effect.

- Both reactions should be measurable by pH change as HCl is consumed in the reactions.
  - reliable in first reaction, but maybe not in second as SO_2 dissolves to form acidic solution.

$$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COOC_2H_5 + H_2O$$

- Slow reaction, $[CH_3COOH]$ can be measured by titration, and should decrease until equilibrium is reached.
- Titrate before and after, with measurements of time, to determine concⁿ change.

Collision Theory

Date No

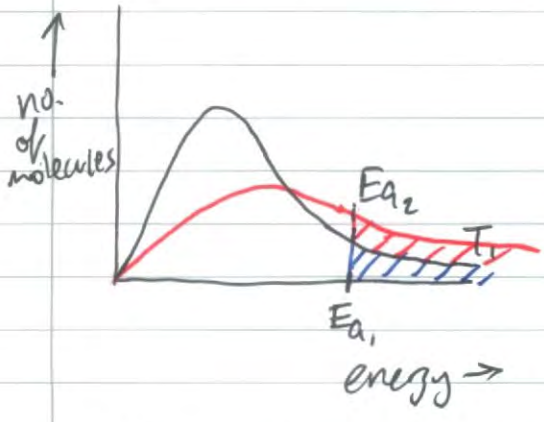
Factors affecting the rate of a chemical reaction:

1. Temperature → all reactions
2. Catalyst → only some, need suitable catalyst.
3. Pressure → gaseous reactions
4. Concentration → (aqueous) solutions
5. Surface area → solids

Collision Theory:
- Chemical reactions take place when molecules collide.
- Collision must have sufficient energy
  * Minimum energy → activation energy.
  * Proper orientation of molecules

S.A. / pressure / conc^n : increasing these factors allows more molecules to collide: increases probability.

Temperature: $\frac{1}{2}mv^2$: increases E_{ic}, so greater v, greater energy.



- initial temp.
- increased temp.

Maxwell–Boltzmann

* 10°C rise in temperature will double the rate of reaction for a reaction with average E_a (by magnitude).