TOPIC 2: KINETICS

$$rate = \frac{\Delta[A]}{\Delta t} \text{ (mol dm}^{-3}\text{ s}^{-1})$$

$$rate = \frac{d[product]}{dt} = -\frac{d[reactants]}{dt}$$

- Mole ratio counts
- Graph of conc. Vs time, the rate is the tangent at any time t
- Rate is proportional to concentration

$$rate = k[conc]^a$$

- **k (rate constant) is always positive**
- **k's units change depending on reaction**
- a indicates the order of the reaction
    - a=0 Zero order (rate is independent of the conc. Rate=k)
    - a=1 First order
    - a=2 Second order
        - $rate = 2k[A]^2$ for only one reactant
    - a can be any number or fraction of a number, can have negative sign
- **Rate law can only be found experimentally**
- Overall reaction order is found by adding the exponents of all species in the rate law
- **Integrated rate law: 1st order**

$$\ln\left(\frac{[A]_t}{[A]_0}\right) = \ln([A]_t) - \ln([A]_0) = -kt$$

$$[A]_t = [A]_0 e^{-kt}$$

- **Half-life for 1st order:**

$$t_{1/2} = \frac{\ln(2)}{k}$$

    - Independent on conc.

- **Integrated rate law: 2nd order**

$$\frac{1}{[A]_t} = \frac{1}{[A]_0} + 2kt$$

- **Half-life for 2nd order:**

$$t_{1/2} = \frac{1}{2k[A]_0}$$

    - Dependent on initial conc.