

What are the factors affecting rate of reaction?

1. Temperature
 - Higher temperature → faster rate of reaction due to higher collision
 - 10° increase = double rate of reaction
 - Batteries run down quickly in cold weather because reactions that generate electric current proceed slower.
2. Concentration
 - Higher concentration = more particle = increase collision = increase rate of reaction
3. Pressure
 - Smaller volume = increase pressure = increase collision
4. Effective surface area
 - = Energy associated in surface
 - 1cm surface cube = 6cm³
 - Aluminium is not very reactive but aluminium nano powder is explosive
 - Reaction between carbonate and acid
5. Catalyst
 - Substance that change the rate of reaction without being used up in the reaction (It lowers activation energy)
 - Eg: Ion chloride, bubble (product) shows up straight away because of catalyst presence (Cl)
 - Catalyst doesn't produce more product, it just produce the same amount more quickly
 - Many catalyst are transition metals: Nickel, Iron, Platinum (less pollution at car exhaust)
 - Benefit of catalyst:
 - Save time and money
 - Reduce the need of high temperature
 - It is essential in biology life (enzyme)

Electrochemistry

→ Inter-conversion of electrical and chemical energy using redox

It can produce electric current or caused by electric current. Example: rechargeable batteries

OILRIG = Oxidation is Loss, Reduction is Gain (electron)

Oxidation	Reduction
Loss of electron	Gain of electron
Increase in oxidation number	Decrease in oxidation number

- Oxidizing agent = oxidize other substance by accepting electron. Itself is reduced in reaction.
- Reducing agent = reduce other substance by donating electron. Itself is oxidized in reaction.

Spontaneous redox reaction: $Zn_{(s)} + Cu^{2+}_{(aq)} \rightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$

- Anode - site of oxidation
- Cathode - site of reduction
- ❖ Positive ion migrate to cathode through salt bridge
- ❖ Negative ion migrate to anode through salt bridge

Cell voltage = the difference in electric potential between anode and cathode

$$E^{\circ}_{\text{cell}} = E^{\circ}_{\text{oxidation}} + E^{\circ}_{\text{reduction}}$$

If E°_{cell} (standard cell potential):

-  Positive → spontaneous
-  0 → equilibrium
-  Negative → non-spontaneous

Example=

- Mg is more active than Cu thus it is spontaneous
- Cu standard reduction is +0.34
- Mg standard reduction is -2.37. Reverse depending which way you go (right or left); its positive or negative

Galvanic/ Voltaic Cell

- ✓ Apparatus that allows redox reaction to occur by transferring electrons through external connector.
- ✓ Product favoured reaction → voltaic or galvanic cell → electrical current
- ✓ Ion comes across the salt bridge
- ✓ Example of voltaic cell: alkaline battery (common reaction); Pb (lead) storage battery is not common anymore
- ✓ Cu plates into Zn metal strips → Zn strip will disappear
- ✓ Zn/Cu is +1.1 V at 25° when concentrations of both are 1 M
- ✓ Example: electrolytic purification of copper

Corrosion on Thursday lecture