Specific heat – the amount of energy needed to raise 1g of a pure substance by 1°C/K.

$$\Delta E = s \cdot m \cdot \Delta T$$

heat capacity – the amount of energy needed to raise an object by 1°C/K.

$$C = m \cdot s \qquad \Delta E = C \cdot \Delta T$$

units of energy

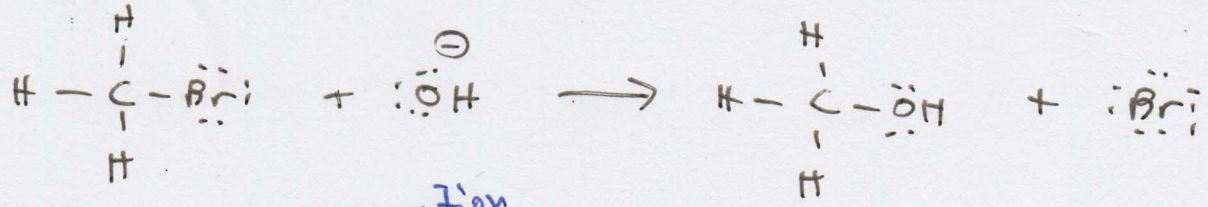
1 cal = 4.184 J

The specific heat of water ≡ 1 cal

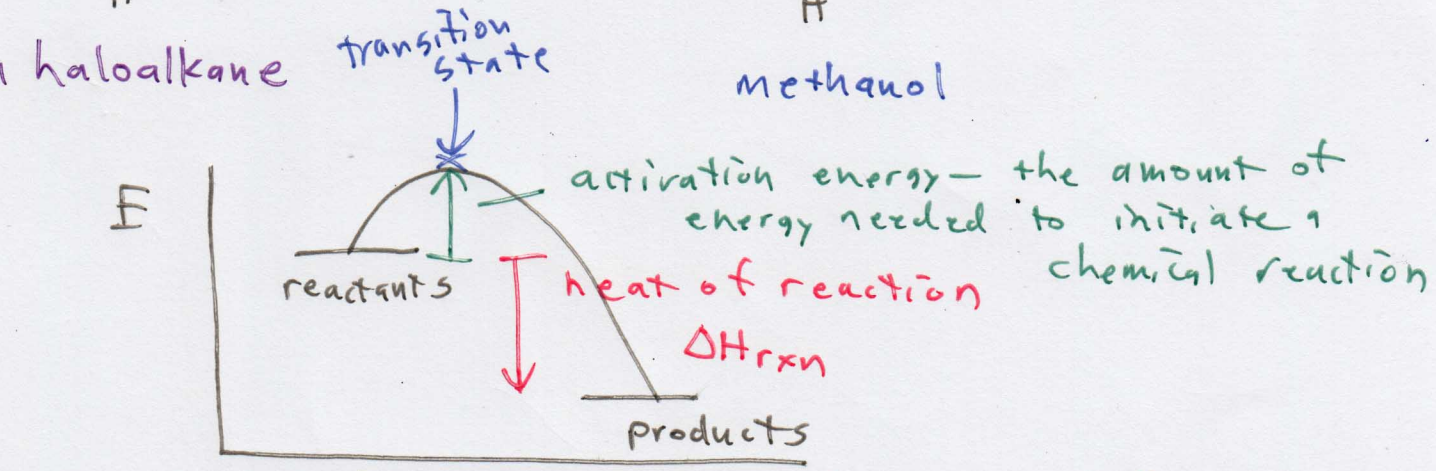
---

amphoteric – a substance that can act as both an acid and a base

---



a haloalkane



methanol

reaction coordinate – the pathways that a reaction will take

thermodynamics – the study of energy changes in a chemical reaction

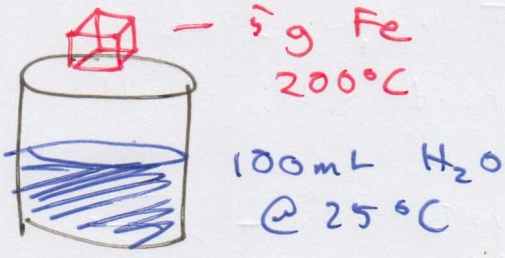
First law of thermodynamics – energy can neither be created nor destroyed, but it can change form.

system – a frame of reference

surroundings – everything not included in a system

isolated system – a system in which neither energy nor matter can cross the boundaries of that system

In an isolated system, the total amount of energy is constant ⟶ $\Delta E = 0$



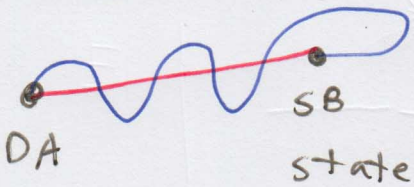
If the cup is treated as an isolated system; $\Delta E = 0$

$$\Delta H_{metal} + \Delta H_{water} = 0$$

$$s_{metal} \cdot m_{metal} \cdot \Delta T_{metal} + s_{water} m_{water} \cdot \Delta T_{water} = 0$$

Calorimetry – the process of measuring energy changes in a physical or chemical reaction

By using the 1st law, calorimetry can be used to measure energy changes in chemical reactions.



— displacement – the distance between two points

state function – a function the value of which does not depend on how a process occurs but only on the initial and final states.

— distance travelled

path function – a function that entirely depends on how a process occurs, not necessarily on its initial and final states.

Energy changes in chemical reactions are state functions, meaning the change in energy only depends on the identity of the reactants and products, not how a chemical reaction occurs.

exothermic – a process that releases energy $\Delta E < 0$

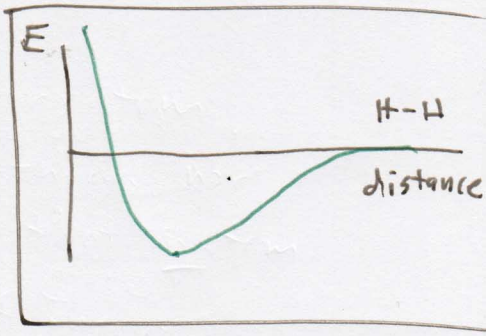
endothermic – a process that absorbs energy $\Delta E > 0$

$$H_2 + Cl_2 \longrightarrow 2\,HCl$$

↑ H-H bonds breaking (endothermic)

↑ Cl-Cl bonds breaking

↑ H-Cl bonds forming (exothermic)



To break costs energy because bonds form in order to lower energy,

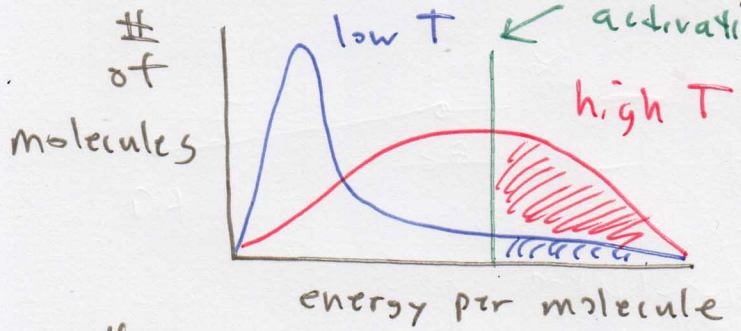
H-H breaker + Cl-Cl breaking + 2 H-Cl forming

+432 kJ/mol + 243 kJ/mol − 2 × 427 kJ/mol

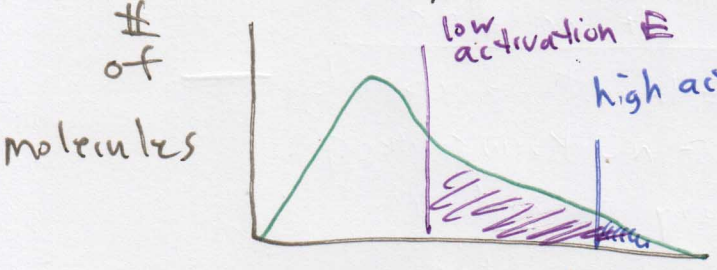
= −179 kJ/mol (exothermic)

kinetics – the study of how reactions occur and how quickly reactions occur.

The rate of a chemical reaction normally depends on ① how the reaction occurs, ② the temperature, ③ the concentration of reagents, ④ the activation energy.

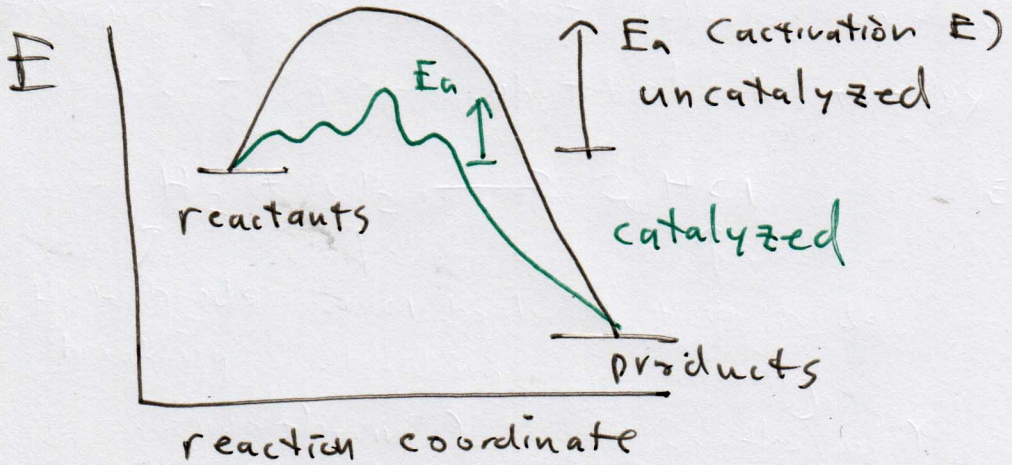


As temperature increases, more molecules have enough energy to pass over the activation energy, so the faster the reaction.



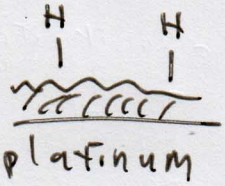
The higher the activation energy, the fewer molecules that have that energy, so the lower the rate of the reaction.

The higher the concentration in solution, the more chances that molecules will collide and have a chance to react, so the faster the reaction.



A catalyst is a substance that provides an alternative reaction pathway that has a lower activation energy, which allows a reaction to occur at a faster rate,

Because a catalyst does not change the identity of reactants or products, a catalyst will not produce more products, it will just produce them more quickly.



entropy - the tendency of both matter and energy to become more spread out

Next Chapter → Chapter 16