수경이가 좋아하는 지엽적인 AP Chemistry

Chapter 6: Thermochemistry

Energy: Capacity to do work

Work: the result of a force acting through a distance

Heat: the flow of energy caused by a temperature difference

Kinetic Energy: the energy associated with the motion of an object

Thermal energy: the energy associated with the temperature of an object (actually a type of kinetic energy)

Potential energy: the energy associated with the position or composition of an object

Chemical energy: the energy associated with the relative positions of electrons and nuclei in atoms and molecules (actually a type of potential energy)

Law of conservation of energy: Energy can be neither created nor destroyed

1calorie (cal) = 4.184J (exact)

The first law of thermodynamics: The total energy of the universe is constant

Internal energy:

- The sum of the kinetic and potential energies of all of the particles that compose the system.
- State function

Internal energy difference: $\Delta E = E_{final} - E_{initial}$ (ΔU 라고 표기하기도 함)

→ In a chemical system: $\Delta E = E_{products} - E_{reactants}$

System → surrounding: $\Delta E_{sys} < 0$, $\Delta E_{surr} > 0$ (when reactants have a higher internal energy than the products)

$\Delta E_{sys} = - \Delta E_{surr}$

$\Delta E = q + w$

q: heat (positive when the system *gains* thermal energy)

w: work (positive when work is done *on* the system)

ΔE: change in internal energy (positive when energy flows *into* the system)

Heat capacity [J/℃]: the quantity of heat required to change the temperature of the system by 1℃

Specific heat capacity [J/(g * ℃)]: the amount of heat required to raise the temperature of 1 gram of the substance by 1℃

$q_{sys} = - q_{surr}$

constant volume: w=0 → $\Delta E = q_v$ (→ constant volume: 열 = 내부 에너지 변화)

bomb calorimeter: constant volume, a piece of equipment designed to measure ΔE for combustion reactions

Enthalpy definition: H = E + PV

Constant pressure: $\Delta H = \Delta E + P\Delta V = q_p$ (→ constant pressure: 열 = 엔탈피 변화)

ΔH > 0: endothermic reaction (absorbs heat from the surroundings)

ΔH < 0: exothermic reaction (gives off heat to the surroundings)

ΔH_{rxn} per mole = q/# of moles

Coffee-cup calorimeter: constant pressure

Standard condition (according to PPT slides)

1) pressure = 1atm

2) Amount/Concentration = 1 mol/L (M)

3) Temperature = 25.0℃ (room temperature)

Standard enthalpy change (ΔH°)

standard states 에서의 hange in enthalpy

Standard enthalpy of formation($\Delta H_f°$)

1) For a pure element (ex: Br_2, C (s, graphite) …): ΔH° = 0

2) For a pure compound: the change of enthalpy when 1 mole of the compound forms from its constituent elements in their standard states. → 외울 필요 없음. 그냥 표 보고 하는 것.

$\Delta H°_{rxn} = \sum n_p \Delta H_f^\circ(\text{products}) - \sum n_r \Delta H_f^\circ(\text{reactants})$

** Real 지엽 **

Driving Forces of Chemical Reactions: Chemical Reactivity (PPT)

1. For a chemical reaction to occur, it MUST have the

    THERMODYNAMICS (에너지)

    KINETICS (activation energy and collisions)

2. “Driving forces” for reactions that are PRODUCT- FAVORED:

    Formation of a precipitate (solid)

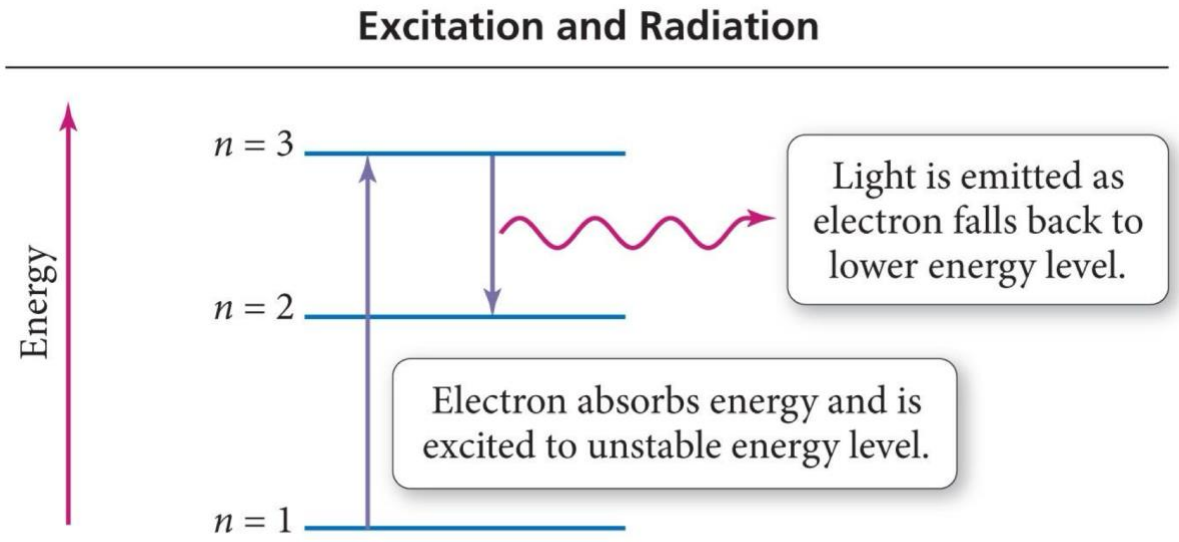
    Gas formation

    Formation of liquid (e.g. H_2O formation in acid/base reaction)

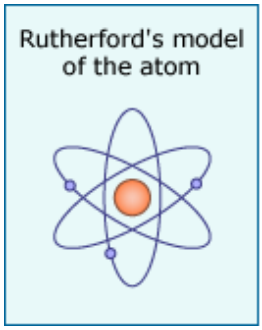
    Electron transfer (redox reactions)

Chapter 7: The Quantum-Mechanical Model of the Atom

Quantum leaps



Evolution of the atom model



1. Rutherford model of the atom

- 빙빙 돌아가는 전자들
- 가운데에 원자핵 있어

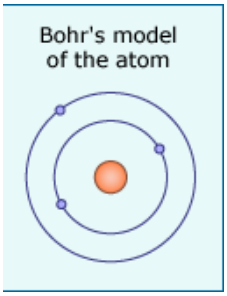
Problems with Rutherford model

① Classical physics doesn't work: + - 만나면 서로 끌어당길 건데 그러면 전자가 원자핵을 쏙 빠져버릴 거 아니얌

② No experimental evidence of this happening

③ Line spectra 나오던데? (러더퍼드 니 말대로라면 excited 되었을 때 연속 스펙트럼 나와야지)

2. The Bohr Atom



- 전자껍질 있다. (전자들은 오직 이 discrete orbit 에만 있을 수 있음. (stationary states/energy levels)
- Electrons are restricted to QUANTIZED energy states or levels around the nucleus.

Good

- Explained line spectra of elements and compounds
- Acknowledged energy absorption/emission is discrete packets of energy

Not so good

- 수소 원자에만 해당

3. Schrodinger's Model:" The Quantum Atom

- Wave Equation: 그 해는 전자의 위치, quantum number 임. 근데 정확한 위치는 몰라. 확률만 알아.
- Quantum mechanics & electrons: Wave nature, not the particulate matter.
  → 전자들은 그냥 확률구름에 있음.

Heisenberg's uncertainty principle

- wave-particle duality nature of the electron → position 과 velocity 를 동시에 알 수 없음.
- 위치 알아 → 운동량 몰라
- 운동량 알아 → 위치 몰라

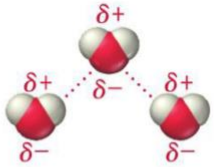
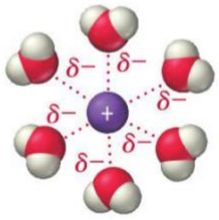
확률분포함수에서 전자 존재 확률이 90%인 점에서 끊어 버림.

이후 (7,8,9,10)는 양자수, 오비탈, 루이스 구조, VSEPR, VB, MO 등등 이야기라서 패스~

Chapter 11: Liquids, Solids, and Intermolecular Forces

Intermolecular force (I will call it IMF from now on ~~(not the International Monetary Fund)~~)

TABLE 11.4 Types of Intermolecular Forces

Type	Present in	Molecular perspective	Strength
Dispersion	All molecules and atoms		
Dipole–dipole	Polar molecules		
Hydrogen bonding	Molecules containing H bonded to F, O, or N		
Ion–dipole	Mixtures of ionic compounds and polar compounds		

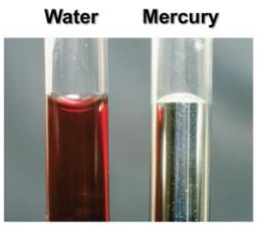
Surface tension of a liquid: the energy required to increase the surface area by a unit amount

- Liquids tend to minimize their surface. → Liquids form drops that are spherical
- The greater the IMF, the greater the energy required to increase the surface area → greater surface tension
- Increase in temperature → reduce surface tension (쉽게 IMF 풀림)

Capillary Action: the ability of a liquid to flow against gravity up a narrow tube

- Cohesive forces: hold the liquid molecules together (액체-액체)
- Adhesive forces: attract the outer liquid molecules to the tube's surface (액체 – 벽)
- Adhesive forces > Cohesive forces 이어야 Capillary Action 발생

- Meniscus: the curved shape of a liquid surface within a tube
    - Adhesive > cohesive: concave (오목)
    - Adhesive < cohesive: convex (볼록)



Water: concave → adhesive > cohesive

Mercury: convex → adhesive < cohesive

IMF 보다 Metallic bond 가 더 강하다는 증거 (ㅃ수은끼리 끌어당김)

- Movement of water up a piece of paper:
  Depends on the H bonds between H_2O and the OH groups of the cellulose in paper
- Chromatography separates the components of a mixture by distinctive attraction to the mobile phase and the stationary phase

Viscosity: the resistance of a liquid to flow. (=the energy required to move an object through a fluid)

- Affected by temperature
    - Temperature 증가 → Liquid's viscosity 감소
- IMF 강해 → Viscosity 큼
- More complex, larger molecule → viscosity 큼

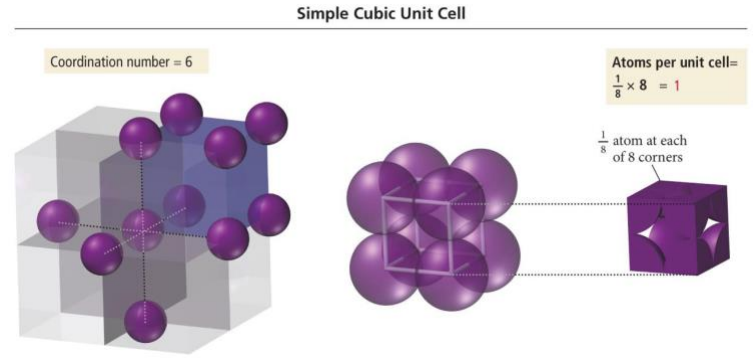
Solubility: "like dissolves like"

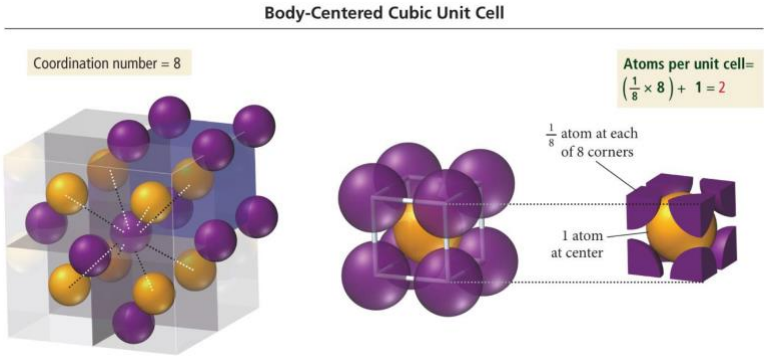
Solvent - solvent 의 IMF bonding 과 Solute – Solute 의 IMF Bonding 을 끊고

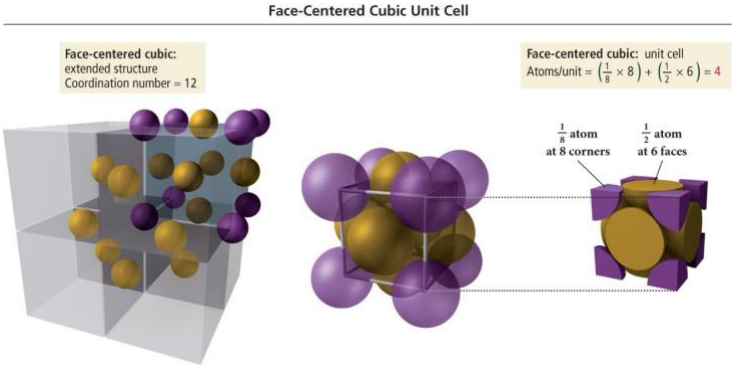
Solvent -Solute 의 IMF Bonding 생성

Solid 에 대하여

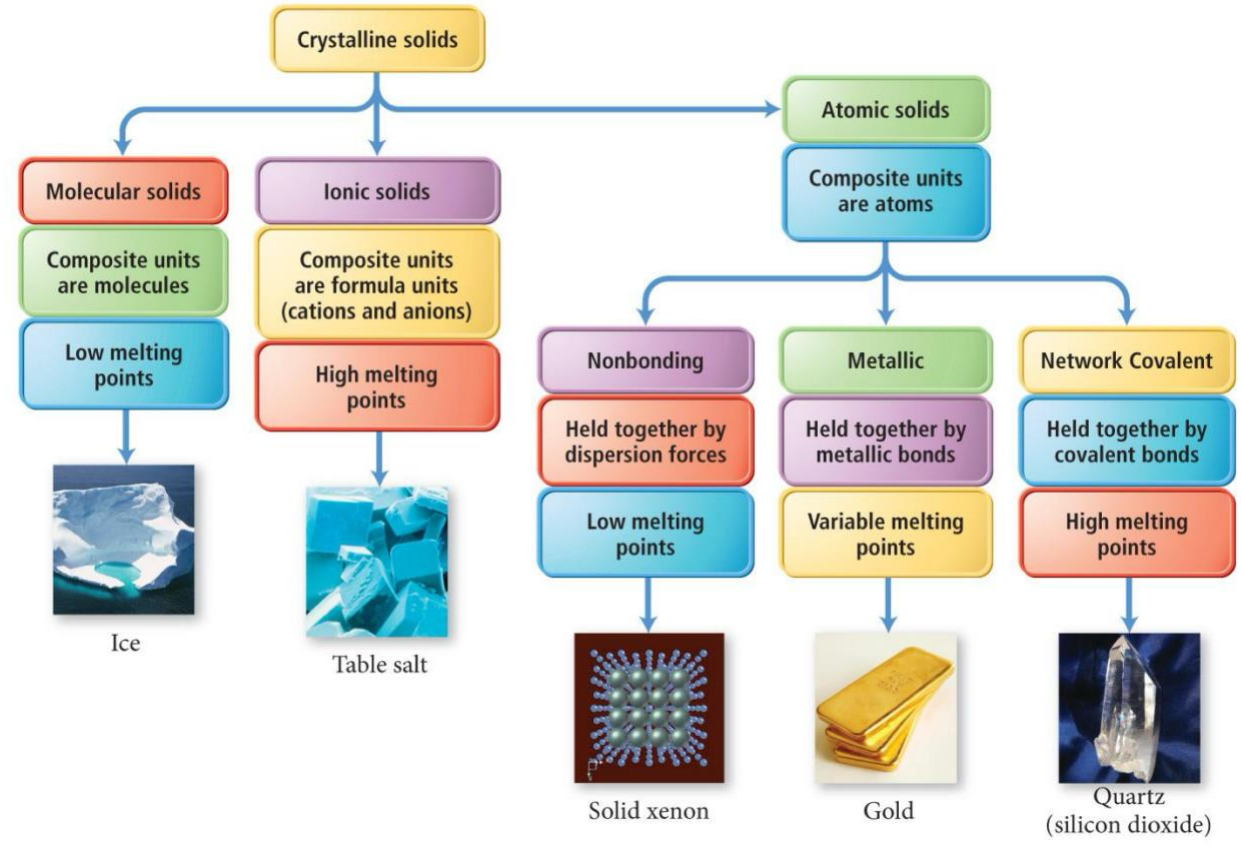
Crystalline solid: 결정. 규칙적인 배열 가짐







종류



<이런 게 있다 정도만>

- Molecular solids (Low m.p.): molecule 로 이루어짐
- Ionic solids (High m.p.): cations + anions 로 이루어짐
- Atomic solids: atom 으로 이루어짐
    - Nonbonding: dispersion force 로 (low m.p.)
    - Metallic : metallic bond 로 (variable m.p.)
    - Network Covalent: covalent bond 로 (high m.p.)

Phase diagram 설명은 생략~

다들 시험 잘 보세요~