

國立臺北大學自然資源與環境管理研究所
104 學年度第一學期『環境工程科學概論』

課程講義(六)：環境化學
Introduction to Environmental Chemistry

● INTRODUCTION

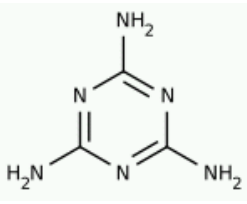
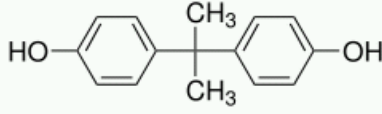
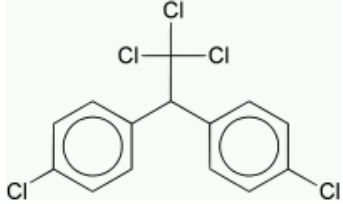
- “Chemistry is the study of matter”
- Chemical Kinetics, Chemical Reaction, and Chemical Equilibrium
- Inorganic Chemicals and Organic Chemicals
- Important Elements
 - ⇒ Carbon, Oxygen, Hydrogen, Nitrogen, Sulfur, and Phosphorus
 - ⇒ Halogen: Fluorine, Chlorine, Bromine
 - ⇒ Heavy Metals: Lead (Pb) 鉛、Arsenic (As) 砷、Cadmium (Cd) 鎘、Mercury (Hg) 汞、Chromium (Cr) 鉻、Other Metals (Atomic Weight > 40)
 - ⇒ RoHS Directive => Pb, Cd, Hg, Cr⁺⁶, 2 Flame Retardants (Polybrominated biphenyls, PBB; Polybrominated diphenyl ether, PBDE)
 - ⇒ Greenhouse Gases: CO₂, CH₄, N₂O, HFCs (Fluorohydrocarbons), PFCs (Perfluorocarbons), SF₆, NF₃
 - ⇒ Rare Earth Elements (REE) => Epitaxy (GIS); Silicon crystal => Wafer

● BASIC CHEMICAL CONCEPTS

- Atoms, Elements, and the Periodic Table => Isotopes
- Chemical Bond and Intermolecular Forces
- Mole, Molar Units (Molarity), and Activity Units
- Chemical Reactions and Stoichiometry
 - ⇒ Balancing Chemical Reactions
 - ⇒ Types of Chemical Reactions: Precipitation-Dissolution Reaction, Complexation Reaction, Oxidation-Reduction (Redox) Reactions
 - ⇒ Reactions Involving Gases, Aqueous Solution, Dissolution and Precipitation
- Chemical Equilibrium
 - ⇒ Precipitation (K_{sp}), Partial Pressure and Molar Rate (Molarity), and pH

● ORGANIC CHEMISTRY

- Alkane, Alkene, and Alkynes => 甲烷、乙烯、丙炔
- Aryl (Aromatic) Compounds
 - ⇒ BTX (Benzene-Toluene-Xylene) and PAH (Polycyclic aromatic hydrocarbon)
 - ⇒ PCB: Polychlorinated biphenyl; PCDDs: Polychlorinated dibenzo-p-dioxins
 - ⇒ DDT: di-chloro-diphenyl-tri-chloro-ethane 二氯二苯基三氯乙烷
 - ⇒ Biodegradable, Recalcitrant, and Persistent
- Phenol：壬基苯酚 (Nonyl Phenol, NP)；雙酚 A (Bisphenol A, BPA)

 <p>三聚氰胺 (Melamine) Cyanurotriamine 化學式：$C_3H_6N_6$ 1,3,5-Triazine-2,4,6-triamine</p>	 <p>雙酚 A，Bisphenol A (BPA) 化學式：$(CH_3)_2C(C_6H_4OH)_2$ 4,4'-dihydroxy-2,2-diphenylpropane</p>	 <p>滴滴涕，雙對氯苯基三氯乙烷 化學式：$(ClC_6H_4)_2CH(CCl_3)$ Dichloro-Diphenyl-Trichloroethane</p>
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- WATER CHEMISTRY

- Physical Properties of Water
- State of Solution Impurities
 - ⇒ Distillation, Precipitation, Adsorption, and Liquid Extraction ⇒ Suspensions
- Concentration Units in Aqueous Solutions or Suspensions
 - ⇒ ppm vs. mg/L; Normality and Equivalent Weight
- Buffers ⇒ Buffering Capacity
- Transport and Fate of Water Pollutants
- Water Purification Techniques ⇒ Necessary? ⇒ Risk of Emerging Technology
 - ⇒ Physical Techniques: Filtration, UV, RO, etc.
 - ⇒ Chemical Techniques: Ion Exchange, Distillation, O_3 , etc.
 - ⇒ Nano-Techniques: Ultrafiltration, Bio-Film, etc.

- ATMOSPHERIC CHEMISTRY

- Compressible Fluids vs. Incompressible Fluids
- Composition of the Atmosphere
- Ideal Gas Law and Ideal Gas Constant ⇒ 22.4 L/mole, 24.5 L/mole
- Dalton's Law of Partial Pressures and Henry Constant
- Concentration of Pollutants in Air
 - ⇒ Gaseous vs. Particulate Pollutants ⇒ ppm(v) vs. mg/m^3
- Photochemical Reactions
- Radiative Forcing and Greenhouse Effect
 - ⇒ Representative Concentration Pathway

- NUCLEAR CHEMISTRY

- HOMEWORK ASSIGNMENT #3 (Due 2015/11/10) :

請收集相關資料以定義何謂「環境賀爾蒙 Environmental Hormones」，並就現行毒性化學物質分類管理制度，討論環境賀爾蒙之管理方式。此外，請就「八仙樂園塵爆事件」，探討那些有機化合物可能造成「塵爆」之激烈化學反應。作業書面內容約 4~8 頁 (A4 Size) (E-Mail 電子檔亦可)。作業內容建議包括：前言、環境賀爾蒙、「塵爆反應」、管理與因應、小結等單元。