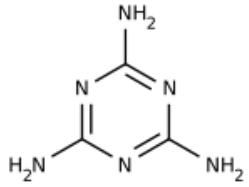
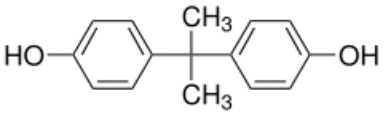
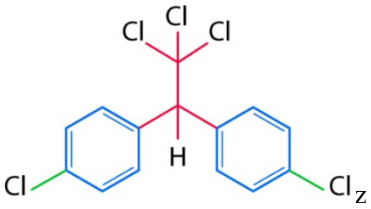
國立臺北大學自然資源與環境管理研究所
110 學年度第一學期『環境工程科學概論』

課程講義(04)：環境化學概要
Introduction to Environmental Chemistry

- REVIEW OF BASIC CHEMICAL CONCEPTS
  - □ "Chemistry is the study of matter"
  - □ 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 => Stochiometry
    - ⇒Types of Chemical Reactions: Precipitation-Dissolution Reaction, Complexation Reaction, Oxidation-Reduction (Redox) Reactions
  - □ Chemical Equilibrium
    - ⇒Precipitation (K_{sp}), Partial Pressure and Molar Rate (Molarity), and pH
  - □ Chemical Kinetics
  - □ 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: CO_2, CH_4, N_2O, HFCs (Flouro-hydrocarbons), PFCs (Perfluorocarbons), SF_6, NF_3
    - ⇒Rare Earth Elements (REE) => Epitaxy (GIS); Silicon crystal => Wafer
  - □ Inorganic Chemicals and Organic Chemicals
    - ⇒Organic Farming and Organic Food
    - ⇒Genetically Modified Organism (GMO)

- ORGANIC CHEMISTRY
  - □ Alkane, Alkene, and Alkynes =>甲烷 Methane、乙烯 Ethylene、丙炔 Propyne
  - □ 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
  - □ Phenol：壬基苯酚（Nonyl Phenol, NP）；雙酚 A（Bisphenol A, BPA）
  - □ Cyanurotriamine (Melamine) 三聚氰胺
    - ⇒Melamine resin 三聚氰胺-甲醛樹脂（美耐皿）

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

- WATER CHEMISTRY
  - □ State of Solution Impurities
    ⇒Distillation, Precipitation, Adsorption, and Liquid Extraction => Suspensions
  - □ Concentration Units in Aqueous Solution s or Suspensions
    ⇒ppm vs. mg/L; Normality and Equivalent Weight
  - □ Transport and Fate of Water Pollutants
  - □ Emerging Water Pollutants

- ATMOSPHERIC CHEMISTRY
  - □ Compressible Fluids vs. Incompressible Fluids
  - □ Composition of the Atmosphere
  - □ Ideal Gas Law and Idea 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
  - □ $E = m C^2$
  - □ Nuclear Fission vs. Nuclear Fusion
  - □ Radiation and Radioactivity: Nuclear Decay and Half Life
  - □ Decommissioning of Nuclear Power Plants

- HOMEWORK ASSIGNMENT #2 (Due 2021/10/26)：
  請定義何謂「毒性及關注化學物質」以回答以下問題
  (1) 一般俗稱的「環境賀爾蒙」(具有內分泌干擾素特性之化學物質）屬於那一類的「毒性化學物質」？「環境賀爾蒙」會對人體造成什麼危害呢？
  (2) 民國 100 年間發生俗稱「塑化劑事件」之食品安全事件，請問該事件之「違法添加物」有那些？這些添加物又會對人體造成何種影響？
  (3) 請概述政府極力推動「食安五環」之方案內容。