

# 國立臺北大學自然資源與環境管理研究所

## 107 學年度第一學期『環境工程科學概論』

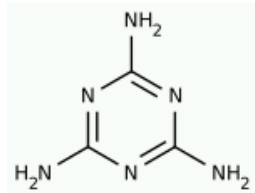
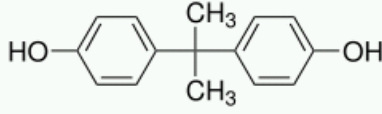
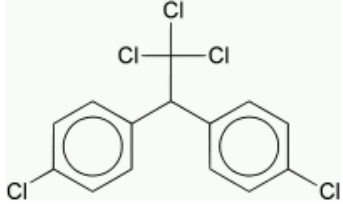
課程講義(06)：環境化學概要  
Introduction to Environmental Chemistry

### ● 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
  - ⇒ 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 (Fluorohydrocarbons), 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、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
- Phenol：壬基苯酚 (Nonyl Phenol, NP)；雙酚 A (Bisphenol A, BPA)

 <p>三聚氰胺 (Melamine) Cyanurotriamine 化學式：<math>C_3H_6N_6</math> 1,3,5-Triazine-2,4,6-triamine</p>	 <p>雙酚 A，Bisphenol A (BPA) 化學式：<math>(CH_3)_2C(C_6H_4OH)_2</math> 4,4'-dihydroxy-2,2-diphenylpropane</p>	 <p>滴滴涕，雙對氯苯基三氯乙烷 化學式：<math>(ClC_6H_4)_2CH(CCl_3)</math> 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
- ☐ 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<sup>3</sup>
- ☐ Photochemical Reactions
- ☐ Radiative Forcing and Greenhouse Effect  
⇒ Representative Concentration Pathway

## ● NUCLEAR CHEMISTRY

- ☐  $E = mc^2$
- ☐ Nuclear Fission vs. Nuclear Fusion
- ☐ Radiation and Radioactivity: Nuclear Decay and Half Life

## ● HOMEWORK ASSIGNMENT #3 (Due 2018/10/30) :

請定義何謂「毒性化學物質」，一般俗稱的「環境賀爾蒙」屬於那一類的「毒性化學物質」？那些化學物質屬「環境賀爾蒙」？「環境賀爾蒙」又會對人體及生態系統造成甚麼危害呢？請簡要整理上述問題的答案或討論。