

# Institute of Natural Resource Management

## National Taipei University

### Class Handout of the Fall Semester, 2013

#### Lectures 6: Environmental Chemistry

- INTRODUCTION

- “Chemistry is the study of matter”
- Chemical Kinetics
- 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)
  - ⇒ Rare Earth Elements (REE) => Epitaxy (GIS); Silicon crystal => Wafer

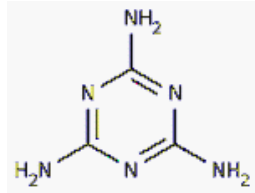
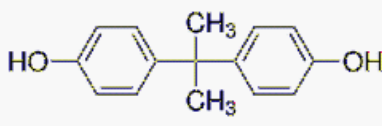
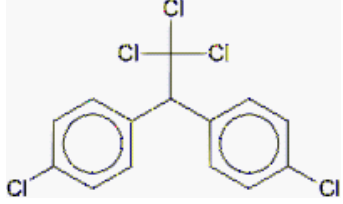
- BASIC CHEMICAL CONCEPTS

- 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
- Reaction Kinetics
  - ⇒ Gas Transfer Across Air-Water Interfaces

- ORGANIC CHEMISTRY

- Alkane, Alkene, and Alkynes => 甲烷、乙烯、丙炔
- Aryl (Aromatic) Compounds
  - ⇒ BTX and PAH
  - ⇒ Isomers: *ortho*, *meta*, *para*
  - ⇒ 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)

□ Functional Groups and Class of Compounds

 <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
- 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

● HOMEWORK ASSIGNMENT #2 (Due 11/05/2013) :

Please collect related materials to define “Environmental Hormones 環境賀爾蒙” or “Endocrine Disruptors 內分泌干擾物質.” What is the management framework of Environmental Hormones regulated by the “Toxic Substance Control Act”? Please complete the homework within 6 pages (A4 size) and hand in electronically via [yml@mail.ntpu.edu.tw](mailto:yml@mail.ntpu.edu.tw). The content is suggested to include: (1) Definition of Environmental Hormones, (2) Characterizations of Environmental Hormones, (3) Toxicity of Environmental Hormones, (4) Regulation and Administration Framework for Environmental Hormones, as well as (5) Summaries.