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# CEE 772: Instrumental Methods in Environmental Analysis

## Lecture #1

Introduction: Course Administration  
and Analytical Review  
(Skoog, Chapt. 1A-1D)  
(pp.1-11)

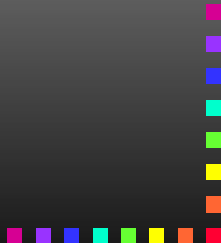
(Harris, Chapt. 0)  
(pp.xvi-12)



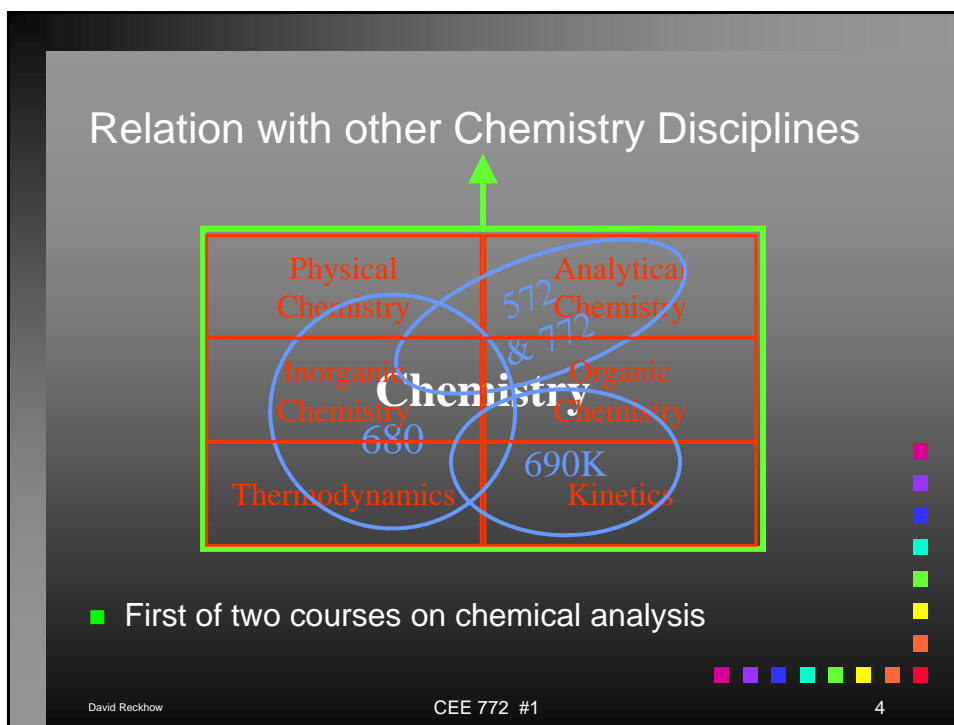
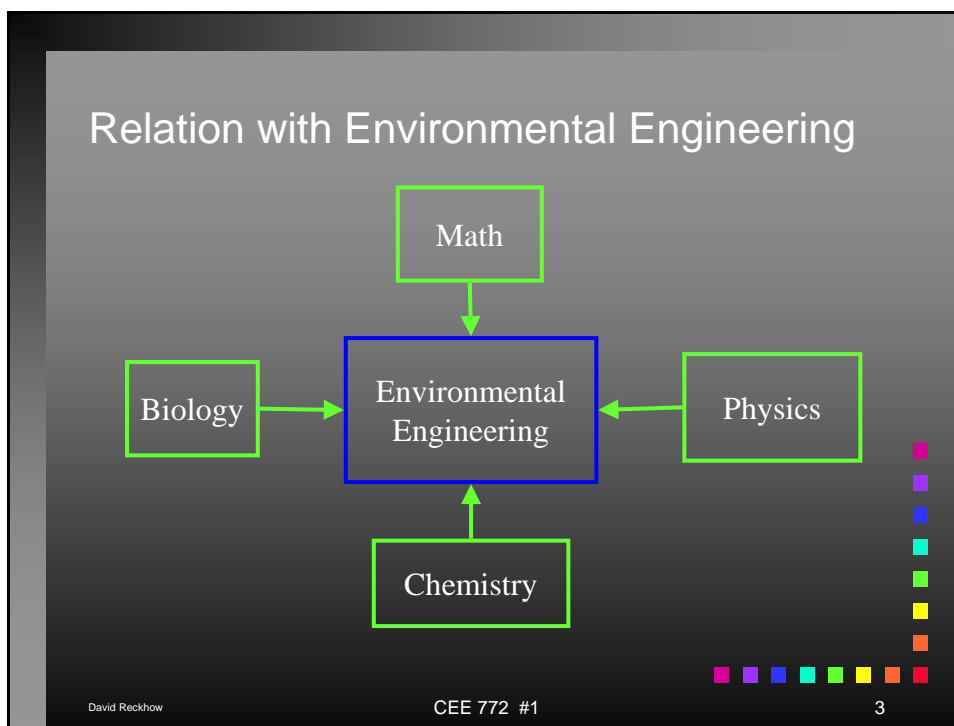
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# Course Administration

- Schedule
  - TuTh: lecture, M: lab in Elab II, room 301/308
- Course Syllabus
- Book: Skoog et al., 2006
  - supplemented by Harris, 2006
  - course notes (Reckhow, 2012)
- Detailed Course Outline
- Instrument Project
  - Design and execute lab exercise
  - Supporting lecture
  - Written report
- Web site



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## Questions for Environmental Analytical Chemists

- How do we assess water quality?
  - What to measure, when and why
- How do we do it?
  - Gravimetry, titrimetry, spectrophotometry, chromatography
- What can chemical analysis tell us?
  - What can't it be used for?
- What is the significance of WQ parameters?
  - Metals, nutrients, solids, organics?
- How should samples be collected and preserved?
  - How do we spot blunders?
- How sure can we be of the measurements?

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## Why learn WQ analysis?

- You may have to make these measurement yourself
  - As a consultant
  - As a utility or industrial employee
  - As a graduate student
- You may need to interpret and critique water quality data collected by others
- You may need to select the types of water quality analyses required for a particular job

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# Review

- Laboratory Basics
  - CEE 577
  - Early Chapters in Harris
- Units
  - Mass based
  - Molarity
  - Molality
  - Normality
  - Mole fraction
  - Atmospheres

- Chemical Stoichiometry
  - mass balance
  - balancing equations
- Thermodynamics
  - law of mass action
  - types of equilibria

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Element Symbol

Atomic Number, Z — 1 — 1.008 — Atomic Molar mass (g/mol)

Electronegativity — 2.20 — Valence Configuration

Element Name

1	H 1.008 Hydrogen																	2	He 4.00 Helium																
3	Li 6.941 Lithium	4	Be 9.012 Beryllium																	10	Ne 20.18 Neon														
11	Na 22.990 Sodium	12	Mg 24.305 Magnesium																	18	Ar 39.94 Argon														
19	K 39.098 Potassium	20	Ca 40.078 Calcium	21	Sc 44.956 Scandium	22	Ti 47.88 Titanium	23	V 50.942 Vanadium	24	Cr 51.996 Chromium	25	Mn 54.938 Manganese	26	Fe 55.847 Iron	27	Co 58.933 Cobalt	28	Ni 58.69 Nickel	29	Cu 63.546 Copper	30	Zn 65.39 Zinc	31	Ga 69.723 Gallium	32	Ge 72.61 Germanium	33	As 74.922 Arsenic	34	Se 78.96 Selenium	35	Br 79.904 Bromine	36	Kr 83.8 Krypton
37	Rb 85.468 Rubidium	38	Sr 87.62 Strontium	39	Y 88.906 Yttrium	40	Zr 91.224 Zirconium	41	Nb 92.906 Niobium	42	Mo 95.94 Molybdenum	43	Tc (98) Technetium	44	Ru 101.07 Ruthenium	45	Rh 102.91 Rhodium	46	Pd 106.42 Palladium	47	Ag 107.87 Silver	48	Cd 112.41 Cadmium	49	In 114.82 Indium	50	Sn 118.71 Tin	51	Sb 121.75 Antimony	52	Te 127.60 Tellurium	53	I 126.91 Iodine	54	Xe 131.29 Xenon
55	Cs 132.91 Cesium	56	Ba 137.33 Barium	57	La 138.91 Lanthanum	58	Ce 140.11 Cerium	59	Pr 140.91 Praseodymium	60	Nd 144.24 Neodymium	61	Pm (145) Promethium	62	Sm 150.36 Samarium	63	Eu 151.96 Europium	64	Gd 157.25 Gadolinium	65	Tb 158.93 Terbium	66	Dy 162.50 Dysprosium	67	Ho 164.93 Holmium	68	Er 167.26 Erbium	69	Tm 168.93 Thulium	70	Yb 173.04 Ytterbium				
87	Fr (223) Francium	88	Ra 226.03 Radium	89	Ac 227.03 Actinium	90	Th 232.04 Thorium	91	Pa 231.04 Protactinium	92	U 238.03 Uranium	93	Np 237.05 Neptunium	94	Pu (244) Plutonium	95	Am (243) Americium	96	Cm (247) Curium	97	Bk (247) Berkelium	98	Cf (251) Californium	99	Es (252) Einsteinium	100	Fm (257) Fermium	101	Md (258) Mendelevium	102	No (259) Nobelium				

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## Chemical Equilibria

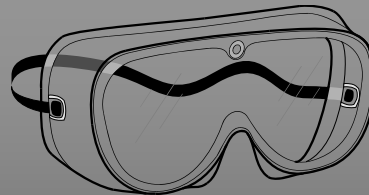
- Law of mass action
  - equilibrium quotients
- Examples
  - ion product of water
  - acid dissociation
  - precipitation
  - redox
  - adsorption
  - volatilization

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## Personal Safety



- Lab coats
  - Recommended for protection from acids & bases
- Goggles
  - Especially important if you don't wear shatter-proof glasses
- Gloves
  - Latex: good flexibility, but leaky
  - Butyl rubber: much better
- General
  - Avoid loose fitting clothing

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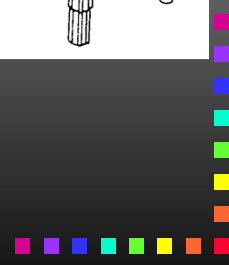
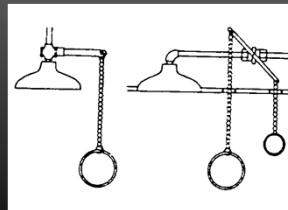
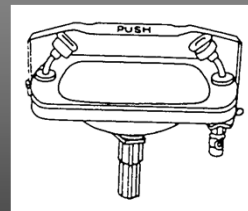
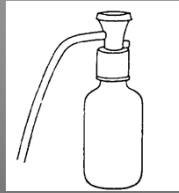
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# Lab Safety

## ■ Washes

- Eye wash
  - Squeeze bottle
  - Plumbed fixture
- Drench Shower



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# Eye wash

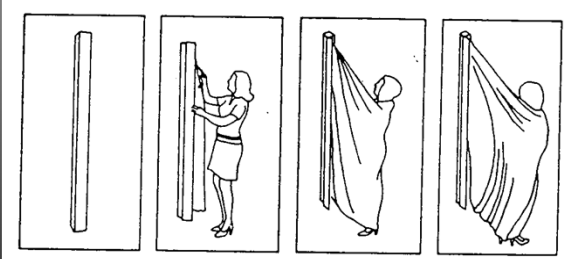
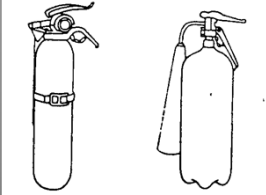
- In Attleboro WTP



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# Lab Safety

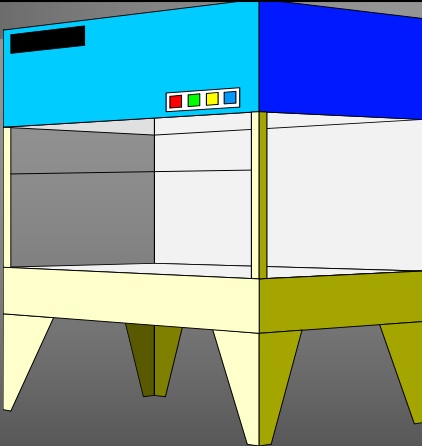
- Fire
  - Extinguisher
  - Fire blanket
- General: EH&S safety manual
  - <http://www.umass.edu/safety/lhs.html>



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# Vapors

- Fume hood
  - Face velocities
  - Sash position
  - EH&S standards
    - <http://www.umass.edu/safety/fume-hood.html>



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# Disposal

- General waste
  - Non recyclables
- Recyclable materials
  - Paper, plastic
- Non hazardous Chemical waste
  - Organic waste (container with EH&S hazardous waste label)
  - Aqueous waste (flushed down a drain after pH neutralization)
- Hazardous wastes
  - Definitions
  - Typical Examples

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■ To next lecture

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