

## CHEM 116 Topics from Harris

### Chapters 0, 1, 2

SI units; prefixes chemical composition: molarity, formality, wt%, ppm, ppb - conversion with density

### Chapter 3 - Experimental Error

significant figures in calculations: rules for +/- and  $\times/\div$

precision, accuracy; determinate (systematic error), indeterminate (random) error

absolute uncertainty, relative and % relative uncertainty (RSD)

### Chapter 4 - Statistics

Gaussian distribution: mean  $\langle x \rangle$  and standard deviation  $s$

degrees of freedom

confidence interval:  $\mu = \langle x \rangle \pm ts/\sqrt{N}$

comparing means with Student's  $t$  - Case 2 - comparing replicate measurements

$t$  test,  $F$  test, Grubbs test - know when and how to use

linear least squares: slope  $m$ ,  $u_m$ ; y-intercept  $b$ ,  $u_b$ ; standard deviation of the fit,  $s_y$

calibration curve and its uncertainty

### Chapters 18 - Fundamentals of Spectrophotometry

electromagnetic radiation:  $\lambda\nu = c$ ,  $E = h\nu$

absorbance and transmittance,  $A = -\log T$

Beer's law -  $A = \epsilon bc$ ;  $\epsilon$  is molar absorptivity,  $b$  is pathlength,  $c$  is concentration

### Chapter 6 - Chemical Equilibrium

chemical equilibrium - equilibrium constant  $K$  and reaction quotient  $Q$

Le Châtelier's principle

common ion effect

electrolytes: strong (completely dissociate), weak (go to equilibrium)

strong acids and bases; weak acids and bases and their associated calculations

acids/bases: Arrhenius (strong acids/bases in Table 6-2 - omit last base, add those given in lecture), Brønsted-Lowry

conjugate acid/base pairs

autoprotolysis reaction - for water,  $K_w$

### Chapter 8 - Activity and the Systematic Treatment of Equilibrium

activities and activity coefficients

be able to write an equilibrium expression with activities

systematic treatment of equilibrium

1. charge balance
2. mass balance(s)
3. equilibrium equations and the corresponding equilibrium constant expressions

### Chapter 9 - Monoprotic Acid-Base Equilibria

systematic treatment of 1) strong acids and bases and 2) monoprotic weak acids and monobasic weak bases

fraction of dissociation of an acid, association of a base

buffers - weak acid/conjugate base or weak base/conjugate acid

1. how to prepare
2. addition of strong acid/base to a weak base/acid
3. be able to use the Henderson-Hasselbalch equation - know approximations for when it is valid

### Chapter 10 - Polyprotic Acid-Base Equilibria

systematic treatment of polyprotic weak acids and polybasic weak bases

relation of  $K_a$  and  $K_b$  for polyprotic systems

finding the pH

1. acidic form
2. intermediate form:  $\text{pH} = \frac{1}{2}(\text{p}K_1 + \text{p}K_2)$  - under what assumptions is this valid
3. basic form

fractional composition and plots (alpha,  $\alpha$ )

polyprotic buffers

determining the principal species

### Chapter 11 - Acid-Base Titrations

titration of strong acids and strong bases - and systematic treatment

titration of weak acids and weak bases - and systematic treatment

titration of polyprotic acids and polybasic bases

1. before the titration begins
2. before the equivalence point - weak acids and weak bases: buffer region, half equivalence point
3. at the equivalence point
4. beyond the equivalence point