Some Review Material for the Chem 223 Final Exam

Equations that will be given to you:

$$m = \frac{m'\left(1 - \frac{d_a}{d_w}\right)}{\left(1 - \frac{d_a}{d}\right)} \qquad s = \sqrt{\frac{\sum_i (x_i - \bar{x})^2}{n-1}} \qquad \mu = \bar{x} \pm \frac{ts}{\sqrt{n}}$$

$$t = \frac{\overline{x_1} - \overline{x_2}}{s_{pooled}} \sqrt{\frac{n_1 n_2}{n_1 + n_2}} \qquad s_{pooled} = \sqrt{\frac{s_1^2(n_1 - 1) + s_2^2(n_2 - 1)}{n_1 + n_2 - 2}}$$

$\Delta G = -nFE = -RT \ln (K)$

$F = 9.64853415 \times 10^4$ C mol^{-1} $\quad N = 6.022 \times 10^{23}$ mol^{-1}

$R = 8.314472$ J mol^{-1} K^{-1} $\quad h = 6.626 \times 10^{-34}$ J s

All needed half-cell potentials and half reactions (but you may need to derive the needed values by combining some of the given values)

$$E = h\nu = \frac{hc}{\lambda} \qquad \frac{[X]}{[X] + [S]} = \frac{A_X}{A_{S+X}} \qquad n\lambda = d(\sin\theta - \sin\phi)$$

$$q^n = \left(\frac{V_{aq}}{V_{aq} + KV_{org}}\right)^n \qquad D = \frac{[H^+]K}{[H^+] + K_a} \qquad N = \frac{5.55 t_r^2}{w_{1/2}^2} \qquad resolution = \frac{\Delta t_r}{w_{av}}$$

Equations and information you need to know that will not be given:

How to calculate the mean

Uncertainty in addition & subtraction: $e_4 = \sqrt{e_1^2 + e_2^2 + e_3^2}$ (use absolute uncertainties)

Uncertainty in multiplication & division: $\%e_4 = \sqrt{\%e_1^2 + \%e_2^2 + \%e_3^2}$ (use relative uncertainties)

How to propagate error through several successive operations

The expressions for K_w, K_a, and K_b.

The relationship $K_w = K_a \bullet K_b$

How to write equilibrium constant expressions for solubility & acid-base problems

The *p* function and the definition of pH

The Henderson-Hasselbalch equation: $pH = pK_a + \log\frac{[base]}{[acid]}$

How to handle titration data for acid-base and redox systems

GER and *LEO* (*g*ain *e*lectrons⇔*r*eduction, *l*ose *e*lectrons⇔*o*xidation)

The rule of vowels: *a*node⇔*o*xidation, *c*athode⇔*r*eduction

How to interpret and write line notation for electrochemical cells (anode always written on the left)

The Nernst equation: $E = E° - \frac{0.05916}{n}\log(Q)$ (at 25 °C)

$E_{cell} = E_+ - E_-$, where E_+ is the potential on the cathode, E_- the potential on the anode

How ion selective electrodes work (in general), with emphasis on the glass pH electrode
Sources of error in using electrodes, especially pH electrodes
How redox indicators work
Beer's Law: $A = \varepsilon bc$
How to do multicomponent analyses using Beer's Law
How a spectrophotometer works
What components are needed for spectroscopic instruments
The Van Deemter equation: $H = A + \frac{B}{u} + Cu$
Types of chromatography
Components of a generic gas chromatograph
Detectors for GC and HPLC
Advantages and applications of temperature programming and gradient elution
Rules for predicting ion affinities for ion exchange resins (charge & solvated radius)
Reactions we used in the lab experiments