CHEAT SHEETS

This may be xeroxed & brought to exams. You may use a highlighter on this sheet only.

Constants

h = 6.62608x10^{-34} J-s
k = 1.38x10^{-23} J/K
c = 3x10^{8} m/s
R = 8.31451 J/mol-K
F = 9.6485x10^{4} C/mol
N = 6.022x10^{23} particles/mole

The Golden Key: The Normal Equation

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

Electronics and Noise and Statistics

V=IR

V = q/C

dq/dt = I

V_o = -$(, - + , +)

$$X_c = \frac{1}{2\pi f C}$$

$$Z = \sqrt{R^2 + X_c^2}$$

$$\Delta f = \frac{1}{t_r}$$

$$R = \frac{\left(\bar{x}_a - \bar{x}_b\right)}{6s}$$

$$\frac{S}{N} = \frac{\bar{x}_a - \bar{x}_b}{s}$$

$$LOD = x_{blank} \pm 3s_{blank}$$

$$LOQ = x_{blank} \pm 9s_{blank}$$

$$6s \approx \left|Peak_{\max}\right| - \left|Peak_{\min}\right|$$

Optics

$$\nu\lambda = c \qquad E = h\nu$$

$$\eta_i = \frac{c}{\nu_i} \qquad f = \frac{\nu_m 2\nu}{c}$$

$$\lambda = \frac{2t\eta}{n} \qquad f = F/d$$

$$W = \frac{\Delta\lambda}{2D^{-1}} \qquad \lambda_{\max} = \frac{2898}{T}$$

$$n\lambda = d(\sin i + \sin r)$$

$$J_\lambda = \left(\frac{2\pi hc^2}{\lambda^5}\right)\left(\frac{d_\lambda}{e^{\frac{hc}{kT\lambda}} - 1}\right)$$

$$P\alpha\left[\frac{1}{f/\#}\right]^2 \qquad R = nN$$

$$\frac{\sin\theta_1}{\sin\theta_2} = \frac{\eta_2}{\eta_1}$$

$$\frac{I_R}{I_o} = \left(\frac{\eta_2 - \eta_1}{\eta_2 + \eta_1}\right)^2$$

$$I_s = \left[\frac{I_o}{\lambda^4}\right]\left[\frac{8\pi^4\alpha^2}{r^2}\right]\left[1 + \cos^2\theta\right]$$

Spectroscopy (100-800 nm)

$$A = -\log T = -\log\left(\frac{P}{P_o}\right) = \log P_o - \log P = \varepsilon bC$$

$$A = \log\left[\frac{P_{o,\lambda_1} + P_{o,\lambda_2}}{P_{o,\lambda_1}\left(10^{-\varepsilon_1 bC}\right) + P_{o,\lambda_2}\left(10^{-\varepsilon_2 bC}\right)}\right]$$

$$\frac{s_c}{C} = \frac{0.434 s_T}{T \log T} \qquad \left|\Delta\lambda_{1/2}\right| = \frac{\lambda^2 \Delta\nu}{c}$$

$$\Delta\lambda = 2\left(\frac{\lambda}{c}\right)\left(\frac{2kT}{\pi m}\right)^{1/2} = 4.848x10^{-7}\lambda\sqrt{\frac{T}{m}}$$

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$$\frac{N_j}{N_o} = \left(\frac{P_j}{P_o}\right) e^{\frac{-\Delta E}{kT}}$$

Spectroscopy > 1:

$$\mu = \frac{m_1 m_2}{m_1 + m_2}$$

$$\nu = \frac{1}{\lambda} = \frac{1}{2\pi c}\sqrt{\frac{k}{\mu}} = 5.3x10^{-12}\sqrt{\frac{k}{\mu}}$$

#bands possible: 3N-5 or 3N-6

$$\Delta N = 2b\left(\nu_1 - \nu_2\right)$$

$$b = \frac{\Delta N}{2\left(\nu_1 - \nu_2\right)}$$

Electrochemistry

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

$$E = E^o - \frac{0.0591}{n}\log\frac{[\mathrm{Re}\,d]}{[Ox]}$$

$$E_{ISE} = const' + 0.0592\log\left(a_{analyte}\right)$$

$$E_{measured} = E_{cell} = E_{rhs} - E_{lhs} = E_{cat} - E_{an}$$

$$\frac{hc}{\lambda} \propto \Delta E^o$$

$$i = nFAD\frac{\partial C}{\partial x} = nFAD\frac{\Delta C}{d}$$

where $d \approx \sqrt{2Dt}$

$$I_{\mathrm{lim}iting,RDE} = 0.620nFAD^{2/3}\nu^{-1/6}w^{1/2}C$$

$$I_{polarography} = 0.607nm^{2/3}D^{1/2}C_{bulk}t^{1/6}$$

$$i_c = AC_d\left[\frac{\partial dE}{\partial t}\right] = AC_d\nu$$

$$q = nFN$$

The Diffusion Equation: Does it Look Familiar?

$$C_{x,t} = \frac{C_o}{\sqrt{4\pi Dt}} e^{-\left(\frac{x^2}{4Dt}\right)}$$

$$= \frac{C_o}{\sqrt{2Dt}\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x}{\sqrt{2Dt}}\right)^2}$$

Chromatography

$$k' = \frac{t_r - t_m}{t_m}$$

$$k' = \frac{KV_s}{V_M}$$

$$\alpha = \frac{t_{r,B} - t_m}{t_{r,A} - t_m} \qquad \alpha = \frac{K_B}{K_A}$$

$$N = \frac{16t_r^2}{W^2} \qquad H = \frac{L}{N}$$

$$H = \frac{W^2 L}{16t_r^2}$$

$$H = \frac{B}{u} + C_s u + C_m u$$

$$B = 2\psi D_m$$

$$C_s = \frac{qk' d_f^2}{(1+k')^2 D_s}$$

$$C_m = \frac{f\left(d_p^2, d_c^2, u\right)}{D_m}$$

$$R_s = \left[\sqrt{\frac{N}{4}}\right]\left[\frac{\alpha - 1}{\alpha}\right]\left[\frac{k'_b}{k'_b + 1}\right]$$

$$t_{r,b} = \left[\frac{H}{u}\right] 16 R_s^2 \left[\frac{\alpha}{\alpha - 1}\right]^2 \left[\frac{\left(1 + k'_b\right)^3}{k'^2_b}\right]$$