CHEM 122 Cheat Sheet

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LIQUIDS AND SOLIDS

h=(2Tcosθ) / (rρg)

$P=Ae^{-\Delta Hvap/(RT)}$

lnP=−ΔHvap/(RT)+lnA

ln(P2/P1)= (ΔHvap/R) (1/T1−1/T2)

nλ=2d sinθ

FUNDAMENTAL EQUILIBRIUM CONCEPTS

$Qc=[C]^c[D]^d / [A]^a[B]^b$

$Qp= [PC]^c[PD]^d / [PA]^a[PB]^b$

P = MRT

Kc = Qc at equilibrium

Kp = Qp at equilibrium

$KP = Kc (RT)^{\Delta n}$

OTHER EQUILIBRIA

$MpXq(s) \rightleftharpoons pM^{m+}(aq)+ qX^{n-}(aq)$

where $Ksp=[M^{m+}]^p[X^{n-}]^q$

THERMODYNAMICS

ΔS= qrev/T

S = k ln W

ΔS=k ln(Wf/Wi)

ΔS° = ∑νS°(products)−∑νS°(reactants)

ΔS=qrev/T

ΔSuniv = ΔSsys + ΔSsurr

ΔSuniv=ΔSsys+ΔSsurr=ΔSsys+ (qsurr/T)

ΔG = ΔH − TΔS

SOLUTIONS / COLLOIDS

$C^g=kP^g$

$(P^A=(X^A) (P^A))$

Psolution=Xsolvent Psolvent

$\Delta T^b = K^b m$

$\Delta T^f = K^f m$

Π = MRT

ACID-BASE EQUILIBRIA

$Kw = [H3O+][OH-] = 1.0 \times 10^{-14}$ (at 25 °C)

pH=−log[H3O+]

pOH = −log[OH−]

$[H3O+] = 10^{-pH}$

$[OH-] = 10^{-pOH}$

pH + pOH = pKw = 14.00 at 25 °C

$Ka=[H3O^+][A^-] / [HA]$

$Kb=[HB^+][OH^-] / [B]$

$Ka \times Kb = 1.0 \times 10^{-14} = Kw$

Percent ionization = ([H3O+]eq / [HA]0) ×100

pKa = −log Ka

pKb = −log Kb

$pH= pKa+ \log ([A^-]/[HA])$

NUCLEAR CHEM

$E = mc^2$

decay rate = λN

$t^{1/2}$= ln2/ λ = 0.693/ λ

rem = RBE × rad

Sv = RBE × Gy

KINETICS

relative reaction rates for aA⟶bB =(−1/a)(Δ[A]/Δt) =(1/b)(Δ[B]/Δt)

integrated rate law for zero-order reactions: [A]t=−kt+[A]0

half-life for a zero-order reaction t1/2= [A]0/(2k)

integrated rate law for first-order reactions: ln[A]t=−kt + ln[A]0

half-life for a first-order reaction t1/2= ln2/k

integrated rate law for second-order reactions: 1/[A]t=kt+ 1/[A]0

half-life for a second-order reaction t1/2 =1/([A]0k)

$k=Ae^{-Ea/RT}$

lnk= (−Ea/R)(1/T) + lnA

lnk(1/k2)= (Ea/R) (1/T2−1/T1)

ELECTROCHEMISTRY

E°cell=E°cathode−E°anode

E°cell=(RT/nF)lnK

E°cell=(0.0257 V/n)lnK = (0.0592 V/n) logK ......(at 298.15K)

Ecell = E°cell − (RT/nF) lnQ .....(Nernst equation)

Ecell = E°cell− (0.0592V/n)logQ ......(at 298.15K)

ΔG = −*nFE*cell

ΔG°=−*nFE*°cell

*w*ele = *w*max =−*nFE*cell

Q = I × t = n × F