

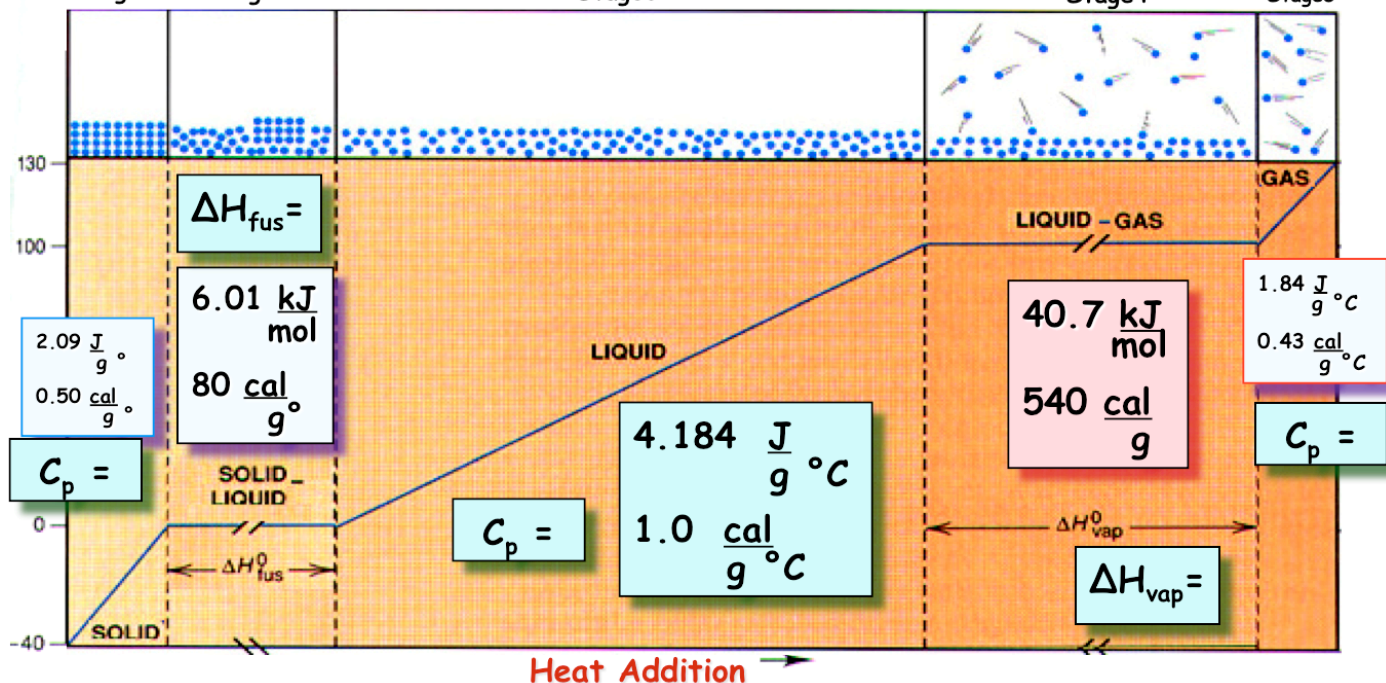
Miscellaneous information for Chemistry 152 (Final Exam)

i Conversion ii Heating-Cooling iii Solutions iv Solubility v Gas laws vi Stoichiometry vii VSEPR viii Acid-base ix Periodic table

i Conversion information:

System	LENGTH:	VOLUME	MASS	Temperature
English:	1 ft = 12 in 1 mile = 5280 ft	1 gal = 4 qt 1 qt = 2 pints 1 pt = 16 fl oz	1 lb = 16 oz 1 ton = 2000 lb	$T(^{\circ}\text{F}) = 1.8 T(^{\circ}\text{C}) + 32$
SI-English:	2.54 cm = 1 in 1.609 km = 1 mi	0.946 L = 1 qt 3.785 L = 1 gal 29.57 mL = 1 fl oz.	453.6 g = 1 lb 28.35 g = 1 oz 1 kg = 2.205 lb	$T(^{\circ}\text{C}) = [T(^{\circ}\text{F}) - 32] / 1.8$
Misc. info	1 mole = $6.02 \cdot 10^{23}$		Density H_2O : 1.0 g / cc	

ii Heating Cooling Curve
Stage1 Stage2 Stage3 Stage4 Stage5



iii Solution and Concentration equations:

Concentrations	M, molarity = moles solute / liter solution N, normality = eq solute / liter solution m, molality = moles solute / Kg solvent % m, percent by mass = (mass solute / mass solution)*100 χ mole fraction = moles a / moles a + moles b ...
Solution Dilution	$C_1 V_1 = C_2 V_2$ (moles before dilution = moles after dilution)
Boiling Pt Elevation	$\Delta T_b = m K_b$
Freezing Pt. Depression	$\Delta T_f = m K_f$

iv Solubility rules:

Soluble Substances		Insoluble Substances	
Containing-	Exceptions	Containing-	Exceptions
Nitrates (NO_3^-) Perchlorates (ClO_4^-) Acetates (CH_3CO_2^-)	None	Carbonates (CO_3^{2-}) Chromates (CrO_4^{2-}) Phosphates (PO_4^{3-}) Sulfides (S^{2-})	Alkali and NH_4^+
Halogens (X^-) Cl^- , Br^- , I^-	Ag, Hg & Pb.	Hydroxides (OH^-)	Ca, Ba, Sr, Alkali & NH_4^+
Sulfates (SO_4^{2-})	Ca, Ba, Hg and Pb	Soluble - dissolve, no precipitate (aq -phase) insoluble (or slightly soluble) - does not dissolve, precipitate forms. (s-phase)	
Alkali (Group1A) NH_4^+	None		

Solubility Table

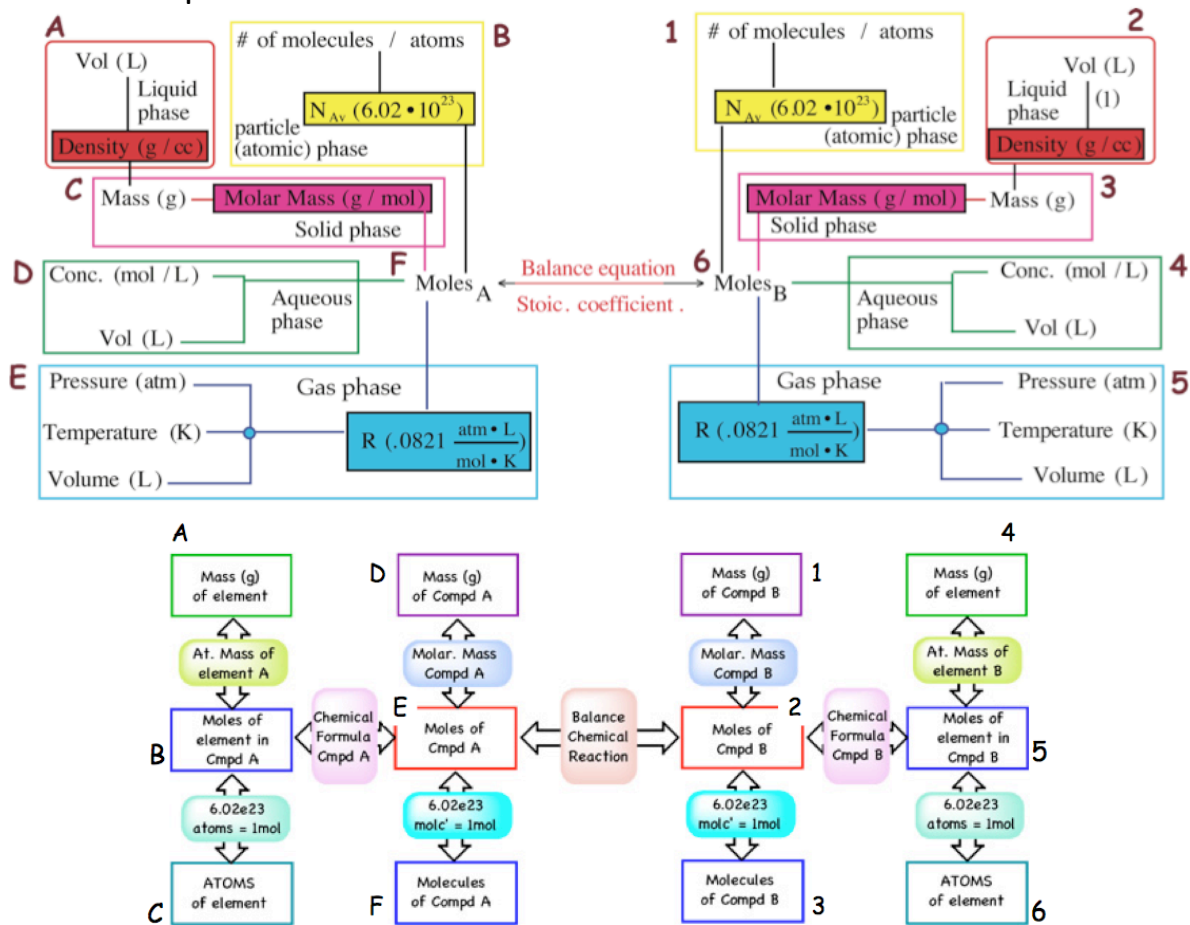
	$\text{C}_2\text{H}_3\text{O}_2^-$	AsO_4^{3-}	Br^-	CO_3^{2-}	Cl^-	CrO_4^{2-}	OH^-	I^-	NO_3^-	$\text{C}_2\text{O}_4^{2-}$	O^{2-}	PO_4^{3-}	SO_4^{2-}	S^{2-}	SO_3^{2-}
Al^{3+}	S	I	S	-	S	-	I	S	S	-	I	I	S	d	-
NH_4^+	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Ba^{2+}	S	I	S	I	S	I	s	S	S	I	s	S	S	S	S
Bi^{3+}	-	s	d	I	d	-	I	I	d	I	I	s	d	I	-
Ca^{2+}	S	I	S	I	S	S	I	S	S	I	I	I	I	d	I
Co^{2+}	S	I	S	I	S	I	I	S	S	I	I	I	S	I	I
Cu^{2+}	S	I	S	I	S	I	I	-	S	I	I	I	S	I	-
Fe^{2+}	S	I	S	s	S	-	I	S	S	I	I	I	S	I	s
Fe^{3+}	I	I	S	I	S	-	I	-	S	S	I	I	S	I	-
Pb^{2+}	S	I	I	I	I	I	I	I	S	I	I	I	I	I	I
Mg^{2+}	S	d	S	I	S	S	I	S	S	I	I	I	S	d	s
Hg^{2+}	S	I	I	I	S	s	I	I	S	I	I	I	d	I	-
K^+	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Ag^+	s	I	I	I	I	I	-	I	S	I	I	I	I	I	I
Na^+	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Zn^{2+}	S	I	S	I	S	I	I	S	S	I	I	I	S	I	I

S= Soluble in water I= Insoluble in water (less than 1g/100g H_2O) s= slightly soluble in water d= Decomposes in water

v Gas law equations:

Ideal Gas Law	$PV = nRT$ Density(D) = $\frac{m \cdot P}{n R T}$, m = mass $R = 0.08206 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}}$
Real Gas: Vander Waal Equation	$\left(P + \frac{a \cdot n^2}{V^2}\right)(V - n \cdot b) = nRT$
STP	$P = 1 \text{ atm}$, $T = 0^\circ\text{C}$, 1 mole = 22.4 L
Dalton's Law of Partial Pressure	$P_T = P_a + P_b + P_c + \dots$ $P_T = \frac{(n_a + n_b + n_c + \dots)R \cdot T}{V_T}$ $P_a = \chi_a \cdot P_T$ $P_b = \chi_b \cdot P_T$ $\chi_a = n_a / n_T$ $\chi_b = n_b / n_T$
Graham's Law of effusion	$\frac{\text{rate}_a}{\text{rate}_b} = \frac{\text{time}_b}{\text{time}_a} = \sqrt{\frac{M_b}{M_a}}$
Calorimetry	$q_p = \Delta H = m C_s \Delta T$ where $\Delta T = T_f - T_i$, $C_s (\text{H}_2\text{O}) = 4.184 \text{ J/g} \cdot \text{K}$

vi Stoichiometric Map



vii Valence Shell Electron-Pair Repulsion Theory (VSEPR) :

Electron Domains (Regions)	AE_n	Electronic Geometry	Bond Pair (Coord #)	non-bond pair	AB_mE_n	Molecular Geometry	Bond angle Hybrid
2	AE_2	Linear	2	0	AB_2	Linear	180° sp
3	AE_3	Trigonal	3	0	AB_3	Trigonal	120° sp ²
			2	1	AB_2E	Bent	$< 120^\circ$ sp ²
4	AE_4	Tetrahedral	4	0	AB_4	Tetrahedral	109.5° sp ³
			3	1	AB_3E	Pyramidal	$< 109.5^\circ$ sp ³
			2	2	AB_2E_2	Bent	$< 109.5^\circ$ sp ³

viii Acid Base:

pX and [X] Relationship	$pH = -\log [H_3O^+]$	$pOH = -\log [OH^-]$	$pK_a = -\log [K_a]$
	$[H_3O^+] = 10^{-pH}$	$[OH^-] = 10^{-pOH}$	$[K_a] = 10^{-pK_a}$
K_w	$K_w = 1 \cdot 10^{-14}$ @ 25°C		$14 = pH + pOH$
Henderson - Hasselbach Equation	$pH = pK_a + \log [C_b/C_a]$	$pOH = pK_b + \log [C_a/C_b]$	
Quadratic Equation $ax^2+bx+c=0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$		

ix Periodic Table

																		Courtesy of Dr. Fred. Garces Miramar College, 2007 fgarces@sdccd.edu					18
													Electronegativity ← Values					VIIIA					
1	1	2											13	14	15	16	17	2					
	IA	IIA	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	VIIIA					
1	1	2											5	6	7	8	9	10					
	H	He											B	C	N	O	F	Ne					
	1.00797	4.0026											10.811	12.0112	14.0067	15.9994	18.9984	20.179					
2	3	4											13	14	15	16	17	18					
	Li	Be	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18					
	6.939	9.0122	IIIB	IVB	VB	VIB	VIIIB		VIIIB		IB	IIB	Al	Si	P	S	Cl	Ar					
	22.9898	24.305											26.9815	28.086	30.9738	32.064	35.453	39.948					
3	11	12	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36					
	Na	Mg	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr					
	39.102	40.08	44.956	47.90	50.942	51.996	54.9380	55.847	58.9332	58.71	63.54	65.37	69.72	72.59	74.9216	78.96	79.909	83.80					
4	19	20	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54					
	K	Ca	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe					
	85.47	87.62	88.905	91.22	92.906	95.94	[99]	101.07	102.905	106.4	107.870	112.40	114.82	118.69	121.75	127.60	126.904	131.30					
5	37	38	71*	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86					
	Rb	Sr	Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn					
	85.47	87.62	174.967	178.49	180.948	183.85	186.2	190.2	192.2	195.09	197.0	200.59	204.37	207.19	208.980	[210]	[210]	[222]					
6	55	56	103†	104	105	106	107	108	109	110	111	112		114		116							
	Cs	Ba	Lr	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg			[289]		[292]							
	132.905	137.34	[260]	[261.11]	[262.11]	[266.12]	[264.12]	[269.13]	[268.14]	[271]	[272]	[277]											
7	87	88																					
	Fr	Ra																					
	[223.02]	[226.03]																					
* Lanthanide Series	57	58	59	60	61	62	63	64	65	66	67	68	69	70									
	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb									
	138.91	140.115	140.9077	144.24	(145)	150.368	151.965	157.25	158.9254	162.50	164.9303	167.26	168.9342	173.04									
† Actinide Series	89	90	91	92	93	94	95	96	97	98	99	100	101	102									
	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No									
	[227.03]	232.0381	231.0359	238.0289	237.048	[244]	[260]	[247]	[247]	[251]	[252]	[257]	[258]	[259]									