

Useful Information for Chemistry 202 Final Exam

Always assume ideal behavior for gases (unless explicitly told otherwise).

$$PV = nRT$$

$$R = 0.08206 \text{ Latm/molK} = 8.314 \text{ J/Kmol}$$

$$K = ^\circ C + 273.0$$

$$N_A = 6.022 \times 10^{23}$$

$$v_{rms} = \sqrt{\frac{3RT}{M}}$$

$$\lambda = \frac{1}{\sqrt{2}(N/V)(\pi d^2)}$$

$$Z_A = A \frac{N}{V} \sqrt{\frac{RT}{2\pi M}}$$

$$Z = 4 \frac{N}{V} d^2 \sqrt{\frac{\pi RT}{M}}$$

Solubility Rules:

1. Most nitrate salts are soluble.
2. Most salts of sodium, potassium, and ammonium cations are soluble.
3. Most chloride salts are soluble. Exceptions: silver, lead(II), and mercury(I) chloride.
4. Most sulfate salts are soluble. Exceptions: calcium, barium, and lead (II) sulfate.
5. Most hydroxide salts can be considered insoluble. Soluble ones: sodium, potassium, and calcium hydroxide.
6. Consider sulfide, carbonate, and phosphate salts to be insoluble.

$$\Delta E = q + w$$

$$H = E + PV$$

$$\Delta S = q_{rev}/T$$

$$G = H - TS$$

Here are some of the formulas we used/derived in studying thermodynamics. An individual formula may or may not apply to a specific problem. This is for you to decide!

$$\Delta S = nR \ln(V_2/V_1)$$

$$\Delta S = \Delta H/T$$

$$C_v = (3/2)R$$

$$C_p = (5/2)R$$

$$\Delta S = nC \ln(T_2/T_1)$$

$$\Delta G = \Delta G^\circ + RT \ln(Q)$$

$$\Delta S_{surr} = -q/T$$

$$w = -P\Delta V$$

$$q_{rev} = nRT \ln(V_2/V_1)$$

$$q = nC\Delta T$$

$$\ln(K) = -\frac{\Delta H^\circ}{R} \left(\frac{1}{T}\right) + \frac{\Delta S^\circ}{R}$$

$$\ln\left(\frac{K_2}{K_1}\right) = -\frac{\Delta H^\circ}{R} \left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

$$k = A e^{-E_a/RT}$$

$$\ln\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

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Table 15.6

Summary of the Kinetics for Reactions of the Type $aA \longrightarrow$ Products That Are Zero, First, or Second Order in [A]

	Order		
	Zero	First	Second
Rate law	Rate = k	Rate = $k[A]$	Rate = $k[A]^2$
Integrated rate law	$[A] = -kt + [A]_0$	$\ln[A] = -kt + \ln[A]_0$	$\frac{1}{[A]} = kt + \frac{1}{[A]_0}$
Plot needed to give a straight line	[A] versus t	$\ln[A]$ versus t	$\frac{1}{[A]}$ versus t
Relationship of rate constant to the slope of the straight line	Slope = $-k$	Slope = $-k$	Slope = k
Half-life	$t_{1/2} = \frac{[A]_0}{2k}$	$t_{1/2} = \frac{0.693}{k}$	$t_{1/2} = \frac{1}{k[A]_0}$

PERIODIC TABLE OF THE ELEMENTS

The periodic table is a tabular arrangement of all known chemical elements. It consists of 18 groups (vertical columns) and 7 periods (horizontal rows). The groups are labeled 1A through 8A along the top. The first period contains two elements: Hydrogen (H) and Helium (He). The second period contains eight elements: Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O), Fluorine (F), and Neon (Ne). The third period contains eight elements: Sodium (Na), Magnesium (Mg), Aluminum (Al), Silicon (Si), Phosphorus (P), Sulfur (S), Chlorine (Cl), and Argon (Ar). The fourth period contains 18 elements: Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), and Krypton (Kr). The fifth period contains 18 elements: Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), and Xenon (Xe). The sixth period contains 32 elements: Cesium (Cs), Barium (Ba), Lanthanum (La*), Hafnium (Hf), Tantalum (Ta), Tungsten (W), Rhenium (Re), Osmium (Os), Iridium (Ir), Platinum (Pt), Gold (Au), HG, Thallium (Tl), Lead (Pb), Bismuth (Bi), Polonium (Po), Astatine (At), and Radon (Rn). The seventh period contains 22 elements: Francium (Fr), Radium (Ra), Actinium (Ac), Ununquadium (Unq), Ununpentium (Unp), Ununhexium (Unh), Ununseptium (Uns), Ununoctium (Uno), Ununoctium (Une), Cerium (Ce), Praseodymium (Pr), Neodymium (Nd), Promethium (Pm), Samarium (Sm), Europium (Eu), Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Holmium (Ho), Erbium (Er), Thulium (Tm), Ytterbium (Yb), and Lutetium (Lu). The lanthanides (Ce to Lu) and actinides (Ac to Lr) are placed below the main body of the table.

1A	26	Fe	55.85	8A
H				
1.008				
3	4			
Li	Be			
6.941	9.012			
11	12			
Na	Mg			
22.99	24.31			
19	20	21	22	3A
K	Ca	Sc	Tl	4A
39.10	40.08	44.96	47.88	5A
Rb	Sr	V	Cr	6A
85.47	87.62	50.94	52.00	7A
55	56	Mn	Fe	
Cs	Ba	Fe	Co	
132.9	137.3	54.94	55.85	
87	88	Ni	Cu	
Fr	Ra	58.93	Zn	
(223)	(226)	58.93	63.55	
89	#	58.93	65.38	
Ac		58.93	69.72	
(227)		58.93	72.59	
104	105	58.93	74.92	
Unq	Unp	58.93	78.96	
106	107	58.93	79.90	
Unh	Uns	58.93	83.80	
108	109	58.93	83.80	
Uno	Une	58.93	83.80	
lanthanides*		58	59	60
		Ce	Pr	Nd
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
actinides†		61	62	63
		Pm	Sm	Eu
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		64	65	66
		Gd	Tb	Dy
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
		67	68	69
		Ho	Er	Tm
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
		70	71	72
		Yb	Lu	Tb
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		73	74	75
		Ta	W	Re
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		76	77	78
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		79	80	81
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		82	83	84
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		85	86	87
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		88	89	90
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		91	92	93
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		94	95	96
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		97	98	99
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		100	101	102
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		101	102	103
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		104	105	106
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		107	108	109
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		110	111	112
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		113	114	115
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5
				164.9
				167.3
				168.9
				173.0
				175.0
		116	117	118
		Tu	Re	Os
		140.1	140.9	144.2
			(145)	(145)
			150.4	152.0
				157.3
				158.9
				162.5