

# CHEM 1210 (Rowley)

## Exam 4 Equations (Chapters 7-9) Fall 2025

### Formulas

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$$\Delta H_{rxn} = \sum_{Broken} n \cdot \Delta H_{Bond} - \sum_{Formed} n \cdot \Delta H_{Bond}$$

$$Bond\ Order = \frac{n_{bonding} - n_{antibonding}}{2}$$

$$P_A = \chi_A P_{total}$$

$$\frac{rate_A}{rate_B} = \sqrt{\frac{M_B}{M_A}}$$

$$Z = \frac{PV_{molar}}{RT}$$

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

$$PV = nRT$$

$$P_{total} = \sum_{i=gas} P_i$$

$$\chi_A = \frac{n_A}{n_{total}}$$

$$K.E. = \frac{3}{2}RT$$

$$P = \frac{nRT}{V - nb} - \frac{n^2a}{V^2}$$

$$\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$$

### Constants

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$$R = 8.314 \frac{J}{mol\ K}$$

$$R = 0.08206 \frac{L\ atm}{mol\ K}$$

# Periodic Table of the Elements

1 <b>H</b> Hydrogen 1.008	2 <b>He</b> Helium 4.003	3 <b>Li</b> Lithium 6.941	4 <b>Be</b> Beryllium 9.012	5 <b>B</b> Boron 10.811	6 <b>C</b> Carbon 12.011	7 <b>N</b> Nitrogen 14.007	8 <b>O</b> Oxygen 15.999	9 <b>F</b> Fluorine 18.998	10 <b>Ne</b> Neon 20.180	11 <b>Na</b> Sodium 22.990	12 <b>Mg</b> Magnesium 24.305	13 <b>Al</b> Aluminum 26.982	14 <b>Si</b> Silicon 28.086	15 <b>P</b> Phosphorus 30.974	16 <b>S</b> Sulfur 32.066	17 <b>Cl</b> Chlorine 35.453	18 <b>Ar</b> Argon 39.948	19 <b>K</b> Potassium 39.098	20 <b>Ca</b> Calcium 40.078	21 <b>Sc</b> Scandium 44.956	22 <b>Ti</b> Titanium 47.867	23 <b>V</b> Vanadium 50.942	24 <b>Cr</b> Chromium 51.996	25 <b>Mn</b> Manganese 54.938	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933	28 <b>Ni</b> Nickel 58.693	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.38	31 <b>Ga</b> Gallium 69.723	32 <b>Ge</b> Germanium 72.631	33 <b>As</b> Arsenic 74.922	34 <b>Se</b> Selenium 78.971	35 <b>Br</b> Bromine 79.904	36 <b>Kr</b> Krypton 83.798	37 <b>Rb</b> Rubidium 85.468	38 <b>Sr</b> Strontium 87.62	39 <b>Y</b> Yttrium 88.906	40 <b>Zr</b> Zirconium 91.224	41 <b>Nb</b> Niobium 92.906	42 <b>Mo</b> Molybdenum 95.95	43 <b>Tc</b> Technetium 98.907	44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.906	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.868	48 <b>Cd</b> Cadmium 112.414	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.711	51 <b>Sb</b> Antimony 121.760	52 <b>Te</b> Tellurium 127.6	53 <b>I</b> Iodine 126.904	54 <b>Xe</b> Xenon 131.294	55 <b>Cs</b> Cesium 132.905	56 <b>Ba</b> Barium 137.328	57 <b>La</b> Lanthanum 138.905	58 <b>Ce</b> Cerium 140.116	59 <b>Pr</b> Praseodymium 140.908	60 <b>Nd</b> Neodymium 144.243	61 <b>Pm</b> Promethium 144.913	62 <b>Sm</b> Samarium 150.36	63 <b>Eu</b> Europium 151.964	64 <b>Gd</b> Gadolinium 157.25	65 <b>Tb</b> Terbium 158.925	66 <b>Dy</b> Dysprosium 162.500	67 <b>Ho</b> Holmium 164.930	68 <b>Er</b> Erbium 167.259	69 <b>Tm</b> Thulium 168.934	70 <b>Yb</b> Ytterbium 173.055	71 <b>Lu</b> Lutetium 174.967	72 <b>Hf</b> Hafnium 178.49	73 <b>Ta</b> Tantalum 180.948	74 <b>W</b> Tungsten 183.84	75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.217	78 <b>Pt</b> Platinum 195.085	79 <b>Au</b> Gold 196.967	80 <b>Hg</b> Mercury 200.592	81 <b>Tl</b> Thallium 204.383	82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.980	84 <b>Po</b> Polonium [208.982]	85 <b>At</b> Astatine 209.987	86 <b>Rn</b> Radon 222.018	87 <b>Fr</b> Francium 223.020	88 <b>Ra</b> Radium 226.025	89 <b>Ac</b> Actinium 227.028	90 <b>Th</b> Thorium 232.038	91 <b>Pa</b> Protactinium 231.036	92 <b>U</b> Uranium 238.029	93 <b>Np</b> Neptunium 237.048	94 <b>Pu</b> Plutonium 244.064	95 <b>Am</b> Americium 243.061	96 <b>Cm</b> Curium 247.070	97 <b>Bk</b> Berkelium 247.070	98 <b>Cf</b> Californium 251.080	99 <b>Es</b> Einsteinium [254]	100 <b>Fm</b> Fermium 257.095	101 <b>Md</b> Mendelevium 258.1	102 <b>No</b> Nobelium 259.101	103 <b>Lr</b> Lawrencium [262]	104 <b>Rf</b> Rutherfordium [261]	105 <b>Db</b> Dubnium [262]	106 <b>Sg</b> Seaborgium [266]	107 <b>Bh</b> Bohrium [264]	108 <b>Hs</b> Hassium [269]	109 <b>Mt</b> Meitnerium [278]	110 <b>Ds</b> Darmstadtium [281]	111 <b>Rg</b> Roentgenium [280]	112 <b>Cn</b> Copernicium [285]	113 <b>Nh</b> Nihonium [286]	114 <b>Fl</b> Flerovium [289]	115 <b>Mc</b> Moscovium [289]	116 <b>Lv</b> Livermorium [293]	117 <b>Ts</b> Tennessine [294]	118 <b>Og</b> Oganesson [294]	119 <b>Uu</b> Ununennium [295]	120 <b>Uub</b> Unbibium [296]	121 <b>Uut</b> Untrium [297]	122 <b>Uuq</b> Unquadrium [298]	123 <b>Uub</b> Unhexium [299]	124 <b>Uuh</b> Unheptium [300]	125 <b>Uus</b> Unseptium [301]	126 <b>Uuq</b> Unoctium [302]	127 <b>Uuh</b> Unnonium [303]	128 <b>Uus</b> Unsextium [304]	129 <b>Uuo</b> Unseptium [305]	130 <b>Uuh</b> Unheptium [306]	131 <b>Uus</b> Unsextium [307]	132 <b>Uuo</b> Unseptium [308]	133 <b>Uuh</b> Unheptium [309]	134 <b>Uus</b> Unsextium [310]	135 <b>Uuo</b> Unseptium [311]	136 <b>Uuh</b> Unheptium [312]	137 <b>Uus</b> Unsextium [313]	138 <b>Uuo</b> Unseptium [314]	139 <b>Uuh</b> Unheptium [315]	140 <b>Uus</b> Unsextium [316]	141 <b>Uuo</b> Unseptium [317]	142 <b>Uuh</b> Unheptium [318]	143 <b>Uus</b> Unsextium [319]	144 <b>Uuo</b> Unseptium [320]	145 <b>Uuh</b> Unheptium [321]	146 <b>Uus</b> Unsextium [322]	147 <b>Uuo</b> Unseptium [323]	148 <b>Uuh</b> Unheptium [324]	149 <b>Uus</b> Unsextium [325]	150 <b>Uuo</b> Unseptium [326]	151 <b>Uuh</b> Unheptium [327]	152 <b>Uus</b> Unsextium [328]	153 <b>Uuo</b> Unseptium [329]	154 <b>Uuh</b> Unheptium [330]	155 <b>Uus</b> Unsextium [331]	156 <b>Uuo</b> Unseptium [332]	157 <b>Uuh</b> Unheptium [333]	158 <b>Uus</b> Unsextium [334]	159 <b>Uuo</b> Unseptium [335]	160 <b>Uuh</b> Unheptium [336]	161 <b>Uus</b> Unsextium [337]	162 <b>Uuo</b> Unseptium [338]	163 <b>Uuh</b> Unheptium [339]	164 <b>Uus</b> Unsextium [340]	165 <b>Uuo</b> Unseptium [341]	166 <b>Uuh</b> Unheptium [342]	167 <b>Uus</b> Unsextium [343]	168 <b>Uuo</b> Unseptium [344]	169 <b>Uuh</b> Unheptium [345]	170 <b>Uus</b> Unsextium [346]	171 <b>Uuo</b> Unseptium [347]	172 <b>Uuh</b> Unheptium [348]	173 <b>Uus</b> Unsextium [349]	174 <b>Uuo</b> Unseptium [350]	175 <b>Uuh</b> Unheptium [351]	176 <b>Uus</b> Unsextium [352]	177 <b>Uuo</b> Unseptium [353]	178 <b>Uuh</b> Unheptium [354]	179 <b>Uus</b> Unsextium [355]	180 <b>Uuo</b> Unseptium [356]	181 <b>Uuh</b> Unheptium [357]	182 <b>Uus</b> Unsextium [358]	183 <b>Uuo</b> Unseptium [359]	184 <b>Uuh</b> Unheptium [360]	185 <b>Uus</b> Unsextium [361]	186 <b>Uuo</b> Unseptium [362]	187 <b>Uuh</b> Unheptium [363]	188 <b>Uus</b> Unsextium [364]	189 <b>Uuo</b> Unseptium [365]	190 <b>Uuh</b> Unheptium [366]	191 <b>Uus</b> Unsextium [367]	192 <b>Uuo</b> Unseptium [368]	193 <b>Uuh</b> Unheptium [369]	194 <b>Uus</b> Unsextium [370]	195 <b>Uuo</b> Unseptium [371]	196 <b>Uuh</b> Unheptium [372]	197 <b>Uus</b> Unsextium [373]	198 <b>Uuo</b> Unseptium [374]	199 <b>Uuh</b> Unheptium [375]	200 <b>Uus</b> Unsextium [376]	201 <b>Uuo</b> Unseptium [377]	202 <b>Uuh</b> Unheptium [378]	203 <b>Uus</b> Unsextium [379]	204 <b>Uuo</b> Unseptium [380]	205 <b>Uuh</b> Unheptium [381]	206 <b>Uus</b> Unsextium [382]	207 <b>Uuo</b> Unseptium [383]	208 <b>Uuh</b> Unheptium [384]	209 <b>Uus</b> Unsextium [385]	210 <b>Uuo</b> Unseptium [386]	211 <b>Uuh</b> Unheptium [387]	212 <b>Uus</b> Unsextium [388]	213 <b>Uuo</b> Unseptium [389]	214 <b>Uuh</b> Unheptium [390]	215 <b>Uus</b> Unsextium [391]	216 <b>Uuo</b> Unseptium [392]	217 <b>Uuh</b> Unheptium [393]	218 <b>Uus</b> Unsextium [394]	219 <b>Uuo</b> Unseptium [395]	220 <b>Uuh</b> Unheptium [396]	221 <b>Uus</b> Unsextium [397]	222 <b>Uuo</b> Unseptium [398]	223 <b>Uuh</b> Unheptium [399]	224 <b>Uus</b> Unsextium [400]	225 <b>Uuo</b> Unseptium [401]	226 <b>Uuh</b> Unheptium [402]	227 <b>Uus</b> Unsextium [403]	228 <b>Uuo</b> Unseptium [404]	229 <b>Uuh</b> Unheptium [405]	230 <b>Uus</b> Unsextium [406]	231 <b>Uuo</b> Unseptium [407]	232 <b>Uuh</b> Unheptium [408]	233 <b>Uus</b> Unsextium [409]	234 <b>Uuo</b> Unseptium [410]	235 <b>Uuh</b> Unheptium [411]	236 <b>Uus</b> Unsextium [412]	237 <b>Uuo</b> Unseptium [413]	238 <b>Uuh</b> Unheptium [414]	239 <b>Uus</b> Unsextium [415]	240 <b>Uuo</b> Unseptium [416]	241 <b>Uuh</b> Unheptium [417]	242 <b>Uus</b> Unsextium [418]	243 <b>Uuo</b> Unseptium [419]	244 <b>Uuh</b> Unheptium [420]	245 <b>Uus</b> Unsextium [421]	246 <b>Uuo</b> Unseptium [422]	247 <b>Uuh</b> Unheptium [423]	248 <b>Uus</b> Unsextium [424]	249 <b>Uuo</b> Unseptium [425]	250 <b>Uuh</b> Unheptium [426]	251 <b>Uus</b> Unsextium [427]	252 <b>Uuo</b> Unseptium [428]	253 <b>Uuh</b> Unheptium [429]	254 <b>Uus</b> Unsextium [430]	255 <b>Uuo</b> Unseptium [431]	256 <b>Uuh</b> Unheptium [432]	257 <b>Uus</b> Unsextium [433]	258 <b>Uuo</b> Unseptium [434]	259 <b>Uuh</b> Unheptium [435]	260 <b>Uus</b> Unsextium [436]	261 <b>Uuo</b> Unseptium [437]	262 <b>Uuh</b> Unheptium [438]	263 <b>Uus</b> Unsextium [439]	264 <b>Uuo</b> Unseptium [440]	265 <b>Uuh</b> Unheptium [441]	266 <b>Uus</b> Unsextium [442]	267 <b>Uuo</b> Unseptium [443]	268 <b>Uuh</b> Unheptium [444]	269 <b>Uus</b> Unsextium [445]	270 <b>Uuo</b> Unseptium [446]	271 <b>Uuh</b> Unheptium [447]	272 <b>Uus</b> Unsextium [448]	273 <b>Uuo</b> Unseptium [449]	274 <b>Uuh</b> Unheptium [450]	275 <b>Uus</b> Unsextium [451]	276 <b>Uuo</b> Unseptium [452]	277 <b>Uuh</b> Unheptium [453]	278 <b>Uus</b> Unsextium [454]	279 <b>Uuo</b> Unseptium [455]	280 <b>Uuh</b> Unheptium [456]	281 <b>Uus</b> Unsextium [457]	282 <b>Uuo</b> Unseptium [458]	283 <b>Uuh</b> Unheptium [459]	284 <b>Uus</b> Unsextium [460]	285 <b>Uuo</b> Unseptium [461]	286 <b>Uuh</b> Unheptium [462]	287 <b>Uus</b> Unsextium [463]	288 <b>Uuo</b> Unseptium [464]	289 <b>Uuh</b> Unheptium [465]	290 <b>Uus</b> Unsextium [466]	291 <b>Uuo</b> Unseptium [467]	292 <b>Uuh</b> Unheptium [468]	293 <b>Uus</b> Unsextium [469]	294 <b>Uuo</b> Unseptium [470]	295 <b>Uuh</b> Unheptium [471]	296 <b>Uus</b> Unsextium [472]	297 <b>Uuo</b> Unseptium [473]	298 <b>Uuh</b> Unheptium [474]	299 <b>Uus</b> Unsextium [475]	300 <b>Uuo</b> Unseptium [476]	301 <b>Uuh</b> Unheptium [477]	302 <b>Uus</b> Unsextium [478]	303 <b>Uuo</b> Unseptium [479]	304 <b>Uuh</b> Unheptium [480]	305 <b>Uus</b> Unsextium [481]	306 <b>Uuo</b> Unseptium [482]	307 <b>Uuh</b> Unheptium [483]	308 <b>Uus</b> Unsextium [484]	309 <b>Uuo</b> Unseptium [485]	310 <b>Uuh</b> Unheptium [486]	311 <b>Uus</b> Unsextium [487]	312 <b>Uuo</b> Unseptium [488]	313 <b>Uuh</b> Unheptium [489]	314 <b>Uus</b> Unsextium [490]	315 <b>Uuo</b> Unseptium [491]	316 <b>Uuh</b> Unheptium [492]	317 <b>Uus</b> Unsextium [493]	318 <b>Uuo</b> Unseptium [494]	319 <b>Uuh</b> Unheptium [495]	320 <b>Uus</b> Unsextium [496]	321 <b>Uuo</b> Unseptium [497]	322 <b>Uuh</b> Unheptium [498]	323 <b>Uus</b> Unsextium [499]	324 <b>Uuo</b> Unseptium [500]	325 <b>Uuh</b> Unheptium [501]	326 <b>Uus</b> Unsextium [502]	327 <b>Uuo</b> Unseptium [503]	328 <b>Uuh</b> Unheptium [504]	329 <b>Uus</b> Unsextium [505]	330 <b>Uuo</b> Unseptium [506]	331 <b>Uuh</b> Unheptium [507]	332 <b>Uus</b> Unsextium [508]	333 <b>Uuo</b> Unseptium [509]	334 <b>Uuh</b> Unheptium [510]	335 <b>Uus</b> Unsextium [511]	336 <b>Uuo</b> Unseptium [512]	337 <b>Uuh</b> Unheptium [513]	338 <b>Uus</b> Unsextium [514]	339 <b>Uuo</b> Unseptium [515]	340 <b>Uuh</b> Unheptium [516]	341 <b>Uus</b> Unsextium [517]	342 <b>Uuo</b> Unseptium [518]	343 <b>Uuh</b> Unheptium [519]	344 <b>Uus</b> Unsextium [520]	345 <b>Uuo</b> Unseptium [521]	346 <b>Uuh</b> Unheptium [522]	347 <b>Uus</b> Unsextium [523]	348 <b>Uuo</b> Unseptium [524]	349 <b>Uuh</b> Unheptium [525]	350 <b>Uus</b> Unsextium [526]	351 <b>Uuo</b> Unseptium [527]	352 <b>Uuh</b> Unheptium [528]	353 <b>Uus</b> Unsextium [529]	354 <b>Uuo</b> Unseptium [530]	355 <b>Uuh</b> Unheptium [531]	356 <b>Uus</b> Unsextium [532]	357 <b>Uuo</b> Unseptium [533]	358 <b>Uuh</b> Unheptium [534]	359 <b>Uus</b> Unsextium [535]	360 <b>Uuo</b> Unseptium [536]	361 <b>Uuh</b> Unheptium [537]	362 <b>Uus</b> Unsextium [538]	363 <b>Uuo</b> Unseptium [539]	364 <b>Uuh</b> Unheptium [540]	365 <b>Uus</b> Unsextium [541]	366 <b>Uuo</b> Unseptium [542]	367 <b>Uuh</b> Unheptium [543]	368 <b>Uus</b> Unsextium [544]	369 <b>Uuo</b> Unseptium [545]	370 <b>Uuh</b> Unheptium [546]	371 <b>Uus</b> Unsextium [547]	372 <b>Uuo</b> Unseptium [548]	373 <b>Uuh</b> Unheptium [549]	374 <b>Uus</b> Unsextium [550]	375 <b>Uuo</b> Unseptium [551]	376 <b>Uuh</b> Unheptium [552]	377 <b>Uus</b> Unsextium [553]	378 <b>Uuo</b> Unseptium [554]	379 <b>Uuh</b> Unheptium [555]	380 <b>Uus</b> Unsextium [556]	381 <b>Uuo</b> Unseptium [557]	382 <b>Uuh</b> Unheptium [558]	383 <b>Uus</b> Unsextium [559]	384 <b>Uuo</b> Unseptium [560]	385 <b>Uuh</b> Unheptium [561]	386 <b>Uus</b> Unsextium [562]	387 <b>Uuo</b> Unseptium [563]	388 <b>Uuh</b> Unheptium [564]	389 <b>Uus</b> Unsextium [565]	390 <b>Uuo</b> Unseptium [566]	391 <b>Uuh</b> Unheptium [567]	392 <b>Uus</b> Unsextium [568]	393 <b>Uuo</b> Unseptium [569]	394 <b>Uuh</b> Unheptium [570]	395 <b>Uus</b> Unsextium [571]	396 <b>Uuo</b> Unseptium [572]	397 <b>Uuh</b> Unheptium [573]	398 <b>Uus</b> Unsextium [574]	399 <b>Uuo</b> Unseptium [575]	400 <b>Uuh</b> Unheptium [576]	401 <b>Uus</b> Unsextium [577]	402 <b>Uuo</b> Unseptium [578]	403 <b>Uuh</b> Unheptium [579]	404 <b>Uus</b> Unsextium [580]	405 <b>Uuo</b> Unseptium [581]	406 <b>Uuh</b> Unheptium [582]	407 <b>Uus</b> Unsextium [583]	408 <b>Uuo</b> Unseptium [584]	409 <b>Uuh</b> Unheptium [585]	410 <b>Uus</b> Unsextium [586]	411 <b>Uuo</b> Unseptium [587]	412 <b>Uuh</b> Unheptium [588]	413 <b>Uus</b> Unsextium [589]	414 <b>Uuo</b> Unseptium [590]	415 <b>Uuh</b> Unheptium [591]	416 <b>Uus</b> Unsextium [592]	417 <b>Uuo</b> Unseptium [593]	418 <b>Uuh</b> Unheptium [594]	419 <b>Uus</b> Unsextium [595]	420 <b>Uuo</b> Unseptium [596]	421 <b>Uuh</b> Unheptium [597]	422 <b>Uus</b> Unsextium [598]	423 <b>Uuo</b> Unseptium [599]	424 <b>Uuh</b> Unheptium [600]	425 <b>Uus</b> Unsextium [601]	426 <b>Uuo</b> Unseptium [602]	427 <b>Uuh</b> Unheptium [603]	428 <b>Uus</b> Unsextium [604]	429 <b>Uuo</b> Unseptium [605]	430 <b>Uuh</b> Unheptium [606]	431 <b>Uus</b> Unsextium [607]	432 <b>Uuo</b> Unseptium [608]	433 <b>Uuh</b> Unheptium [609]	
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