Instructions

1) This exam requires the Respondus Lockdown Browser with Monitoring; you will not be able to take the exam with any other browser nor if you don't have a webcam.
2) You are allowed to use this coversheet, a calculator, paper and pen/pencil during this exam.
3) Other references or aids are not allowed. Headphones are not allowed.
4) You are responsible to locate an appropriate testing environment where you can work alone while having reliable internet access.
5) Your "Environmental Check" must include the entire room and items on the desk.
6) You should remain in view of the webcam throughout the entire exam.

PERIODIC TABLE OF THE ELEMENTS

1 IA	2 IIA	3 IIIB	4 IVB	5 VB	6 VIB	7 VIIB	8 ------	9 VIIIB	10 ------	11 IB	12 IIB	13 IIIA	14 IVA	15 VA	16 VIA	17 VIIA	18 VIII A
1 **H** 1.008																	2 **He** 4.003
3 **Li** 6.941	4 **Be** 9.012											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
11 **Na** 22.99	12 **Mg** 24.31											13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.07	17 **Cl** 35.45	18 **Ar** 39.95
19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.88	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.69	29 **Cu** 63.55	30 **Zn** 65.39	31 **Ga** 69.72	32 **Ge** 72.61	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** (98)	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.4	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.6	53 **I** 126.9	54 **Xe** 131.3
55 **Cs** 132.9	56 **Ba** 137.3	57 **La** 138.9	72 **Hf** 178.5	73 **Ta** 180.9	74 **W** 183.8	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197.0	80 **Hg** 200.6	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209.0	84 **Po** (209)	85 **At** (210)	86 **Rn** (222)
87 **Fr** (223)	88 **Ra** 226.0	89 **Ac** 227.0	104 **Rf** (267)	105 **Db** (268)	106 **Sg** (269)	107 **Bh** (270)	108 **Hs** (277)	109 **Mt** (278)	110 **Ds** (281)	111 **Rg** (282)	112 **Cn** (285)	113 **Nh** (286)	114 **Fl** (289)	115 **Mc** (289)	116 **Lv** (293)	117 **Ts** (294)	118 **Og** (294)

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce 140.1	**Pr** 140.9	**Nd** 144.2	**Pm** (145)	**Sm** 150.4	**Eu** 152.0	**Gd** 157.3	**Tb** 158.9	**Dy** 162.5	**Ho** 164.9	**Er** 167.3	**Tm** 168.9	**Yb** 173.0	**Lu** 175.0
90 **Th** 232.0	91 **Pa** 231.0	92 **U** 238.0	93 **Np** (237)	94 **Pu** (244)	95 **Am** (243)	96 **Cm** (247)	97 **Bk** (247)	98 **Cf** (251)	99 **Es** (252)	100 **Fm** (257)	101 **Md** (258)	102 **No** (259)	103 **Lr** (262)

Constants and Factors:

$$R = 8.314\frac{J}{mol \cdot K} = 0.08206\frac{L \cdot atm}{mol \cdot K} \qquad 1atm = 760torr$$

$$N_A = 6.022x10^{23} \qquad h = 6.63x10^{-34} J \cdot s \qquad c = 3.00x10^{8} m/s$$

$$R_h = 1.097x10^{7} m^{-1} \qquad B = -2.18x10^{-18} J \qquad m_e = 9.11x10^{-31} kg$$

$$T_K = T_C + 273.15$$

Equations:

$q = mC_S\Delta T$ $\Delta H^\circ_{RXN} = \sum_{Prod} n\Delta H^\circ_f - \sum_{React} n\Delta H^\circ_f$ $PV = nRT$

$u_{rms} = \sqrt{\frac{3RT}{M}}$ $P_A = \chi_A \cdot P_T$ $c = \lambda\nu$ $E = h\nu$

$p = mv$ $\lambda = \frac{h}{p}$ $\frac{1}{\lambda} = R_h\left(\frac{1}{n_a^2} - \frac{1}{n_b^2}\right) E = \frac{-Z^2B}{n^2}$

$E = \frac{kQ_1Q_2}{r}$ $b.o. = 1/2(\#e^- - \#e^{-*})$ $\Delta H \approx \sum_{bonds\ broken} D - \sum_{bonds\ formed} D$