CHM-115-A

Final Exam Instructions **NAME** _____

1. All multiple choice answers are to be submitted on the answer sheet provided. The **best** answer to each question should be indicated by marking with a **pencil** in the space provided. There is only one answer for each question. **Turn in both the answer sheet and the exam.**
2. Print your name on the computer answer sheet. Then code it by darkening the appropriate letters with a **pencil**. Code your LAST (family) name **first**.
3. Code your identification number (ASU 10-digit Affiliate ID, not your Social Security Number) in the "Identification #" section of the answer sheet. **This is very important.** Failure to properly code the answer sheet could result in the loss of your grade.
4. Put all calculations on the examination pages. **Do not put any extra marks on the computer answer sheet.**
5. Since the examination will be computer graded, read the directions for marking answers, located on the back of the answer sheet very carefully before starting.
6. The computer answer sheet and the exam will not be returned to you but may be viewed in PS H-240 if there is any question of accuracy in grading.
7. You may explain answers to any questions if you are unsure of your answer. These answers will be graded for **partial credit** if you are close enough to a grade borderline for extra points to make a difference. Mark the question with an asterisk (*) in the margin and place your explanation on the back of that page.
8. The exam consists of 50 multiple choice questions worth 4 points each. Make sure that your copy of the exam contains all questions.
9. Grades will be posted in my display case near the second-floor H-wing labs.
10. Some information you may find useful:

$T = t + 273.15$

$PV = nRT$

$\Delta E = q + w,\ \Delta E = \Delta H - P\Delta V$

$w = -P\Delta V = -\Delta n_{gas}RT$

$R = 0.08206$ L atm/mol K $= 8.314$ J/mol K

$\Delta S_{vap} = \Delta H_{vap}/T_{boil},\ \Delta S_{fus} = \Delta H_{fus}/T_{melt}$

$\Delta S° = \Sigma nS°_{products} - \Sigma nS°_{reactants}$

$\Delta H° = \Sigma n\Delta H°_f(products) - \Sigma n\Delta H°_f(reactants)$

$\Delta G° = \Sigma n\Delta G°_f(products) - \Sigma n\Delta G°_f(reactants)$

$\Delta G = \Delta H - T\Delta S,\ \Delta G° = \Delta H° - T\Delta S°$

$\Delta G = \Delta G° + RT \ln Q$

$Q = \pi P_{products}^{a}/\pi P_{reactants}^{b}$

$Q = \pi[products]^{a}/\pi[reactants]^{b}$

$\Delta G° = -RT \ln K$

Zero order: $-\Delta[A]/\Delta t = k,\ [A] = [A]_o - kt,$
$t_{½} = [A]_o/2k$

First order: $-\Delta[A]/\Delta t = k[A],$
$\ln[A] = \ln[A]_o - kt,$
$t_{½} = 0.693/k$

Second order: $-\Delta[A]/\Delta t = k[A]^2,$
$[A]^{-1} = [A]_o^{-1} + kt,$
$t_{½} = 1/k[A]_o$

$\Delta H° = E_{a,f} - E_{a,r}$

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

$\ln (k_1/k_2) = (E_a/R)(T_2^{-1} - T_1^{-1})$

$K_c = k_f/k_r$

$aA + bB \rightleftharpoons cC + dD \qquad K_c = [C]^c[D]^d/[A]^a[B]^b$

$K_p = K_c (RT)^{\Delta n(gas)}$

$\ln K = -\Delta H°/RT + \Delta S°/R$

$\ln(K_1/K_2) = (\Delta H°/R)(T_2^{-1} - T_1^{-1})$

$ax^2 + bx + c = 0,\ x = \{-b \pm \sqrt{(b^2 - 4ac)}\}/2a$

$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14}$ at 25°C

$pH = -\log [H_3O^+]$

$pX = -\log X$

$pH + pOH = pK_w = 14$

$K_w = K_aK_b$

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

Acid	Base
$HClO_4$	ClO_4^-
H_2SO_4	HSO_4^-
HI	I^-
HBr	Br^-
HCl	Cl^-
HNO_3	NO_3^-
H_3O^+	H_2O
HSO_4^-	SO_4^{2-}
H_2SO_3	HSO_3^-
H_3PO_4	$H_2PO_4^-$
HNO_2	NO_2^-
HF	F^-
CH_3CO_2H	$CH_3CO_2^-$
H_2CO_3	HCO_3^-
H_2S	HS^-
NH_4^+	NH_3
HCN	CN^-
HCO_3^-	CO_3^{2-}
HS^-	S^{2-}
H_2O	OH^-
NH_3	NH_2^-
OH^-	O^{2-}

$E°_{rxn} = E°_{ox} + E°_{red}$

$E°_{cell} = E°_{ox} + E°_{red}$

$\Delta G = -n\mathbf{F}E$

$\Delta G° = -n\mathbf{F}E°$

$\mathbf{F} = 96500$ coul/mol e^-

$E°_3 = (n_1 E°_1 + n_2 E°_2)/n_3$

$E = E° - (2.303RT/n\mathbf{F}) \log Q = E° - 0.05916/n \log Q$

$E° = (2.303RT/n\mathbf{F}) \log K = 0.05916/n \log K$

$N = N^o e^{-kt} = N^o e^{-0.693\ t/t_{½}}$

$E = mc^2$

E in MeV $= 931.48$ MeV/amu x mass defect in amu

mass of electron $= 0.000549$ amu

mass of proton $= 1.00728$ amu

mass of neutron $= 1.00867$ amu

Spectrochemical Series:
C > N > O > F > Cl > S > Br > I