The Periodic Table

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB	VIIIB	VIIIB	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
H 1 1.01																	He 2 4.00
Li 3 6.94	Be 4 9.01											B 5 10.81	C 6 12.01	N 7 14.01	O 8 16.00	F 9 19.00	Ne 10 20.18
Na 11 22.99	Mg 12 24.31											Al 13 26.98	Si 14 28.09	P 15 30.97	S 16 32.07	Cl 17 35.45	Ar 18 39.95
K 19 39.10	Ca 20 40.08	Sc 21 44.96	Ti 22 47.88	V 23 50.94	Cr 24 52.00	Mn 25 54.94	Fe 26 55.85	Co 27 58.93	Ni 28 58.69	Cu 29 63.55	Zn 30 65.39	Ga 31 69.72	Ge 32 72.61	As 33 74.92	Se 34 78.96	Br 35 79.90	Kr 36 83.80
Rb 37 85.47	Sr 38 87.62	Y 39 88.91	Zr 40 91.22	Nb 41 92.91	Mo 42 95.94	Tc 43 (97.9)	Ru 44 101.07	Rh 45 102.91	Pd 46 106.42	Ag 47 107.87	Cd 48 112.41	In 49 114.82	Sn 50 118.71	Sb 51 121.76	Te 52 127.60	I 53 126.90	Xe 54 131.29
Cs 55 132.91	Ba 56 137.33	La 57 138.91	Hf 72 178.49	Ta 73 180.95	W 74 183.85	Re 75 186.21	Os 76 190.2	Ir 77 192.22	Pt 78 195.08	Au 79 197.97	Hg 80 200.59	Tl 81 204.38	Pb 82 207.2	Bi 83 208.98	Po 84 (209)	At 85 (210)	Rn 86 (222)
Fr 87 223.02	Ra 88 226.03	Ac 89 227.03	Rf 104 (261)	Db 105 (262)	Sg 106 263)	Bh 107 (262)	Hs 108 (265)	Mt 109 (266)	Ds 110 (271)	Rg 111 (272)	Uub 112 (285)	Uut 113 (284)	Uuq 114 (289)	Uup 115 (288)			

Ce 58 140.12	Pr 59 140.91	Nd 60 144.24	Pm 61 (145)	Sm 62 150.36	Eu 63 152.97	Gd 64 157.25	Tb 65 158.93	Dy 66 162.50	Ho 67 164.93	Er 68 167.26	Tm 69 168.93	Yb 70 173.04	Lu 71 174.97
Th 90 232.04	Pa 91 231.04	U 92 238.03	Np 93 237.05	Pu 94 (240)	Am 95 243.06	Cm 96 (247)	Bk 97 (248)	Cf 98 (251)	Es 99 252.08	Fm 100 257.10	Md 101 (257)	No 102 259.10	Lr 103 262.11

Some Useful Formula and Constants:

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

$$pH + pOH = 14 \text{ @ } 25^\circ C$$

$$K_a K_b = 1 \times 10^{-14} \text{ @ } 25^\circ C$$

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

$$K_w = 1 \times 10^{-14} \text{ @ } 25^\circ C$$

SID | | | | | | | | | Last ____________________ First ____________________

Question 1 8 Points	Consider the following reaction where K_c = **77.52** at 600 K: $CO(g) + Cl_2(g) \rightleftharpoons CoCl_2(g)$ A reaction mixture was found to contain **0.128** moles of **$COCl_2(g)$**, **$5.22x10^{-2}$** moles of **$CO(g)$**, and **$4.35x10^{-2}$** moles of **$Cl_2(g)$**, in a **1.00 Liter container**. Indicate **True** (T) or **False** (F) for each of the following: a) In order to reach equilibrium **$COCl_2(g)$** must be **produced**. ______ b) In order to reach equilibrium **K_c** must **decrease**. ______ c) In order to reach equilibrium **$CO(g)$** must be **produced**. ______ d) **Q** is ***greater*** than **K**. ______
Question 2 5 Points	Consider the following equilibrium: $NH_3(g) + HI(g) \rightleftharpoons NH_4I(s)$ ***Circle the statement that is correct*** with respect to Kc and Kp for this equilibrium. ☐ **$K_c = K_p$** ☐ **$K_c > K_p$** ☐ **$K_c < K_p$**
Question 3 8 Points	The equilibrium constant, K_c, for the following reaction is **$3.05x10^{-3}$ at 262K**. $2\ NOBr(g) \rightleftharpoons 2\ NO(g) + Br_2(g)$ ***Calculate K_c and K_p*** at this temperature for the following reaction **at 262K**: $NO(g) + \frac{1}{2} Br_2(g) \rightleftharpoons NOBr(g)$ R = 0.0821 $L.atm.mol^{-1}.K^{-1}$ **K_c** = ______ **K_p** = ______
Question 4 9 Points	Consider the following system at equilibrium where $\Delta H°$ = **-16.1 kJ**, and **Kc = $1.54x10^2$**, at 298 K. $2\ NO(g) + Br_2(g) \rightleftharpoons 2\ NOBr(g)$ If the **TEMPERATURE** on the equilibrium system is suddenly **increased**: The value of **Kc** ❑ Increases ❑ Decreases ❑ Remains the same **[Br_2]** ❑ Increases ❑ Decreases ❑ Remains the same The **value of Q** ❑ Is ***greater*** than Kc ❑ Is **less than** Kc ❑ Is **equal to** Kc
Question 5 4 Points	HCN is a weak acid – $HCN(aq) + H_2O(l) \rightleftharpoons H_3O^+ + CN^-$ **K_c = $4.0x10^{-10}$ @ 298K** ***Addition*** of **OH^-** to this equilibrium will cause the **[HCN]** to a) ***Increase*** c) Remain ***unchanged*** b) ***Decrease*** d) ***Impossible*** to determine

Question 6 **8 Points**	Consider the following system at equilibrium where K_c = **6.50x10^{-3}** and $\Delta H°$ = **16.1 kJ/mol** at **298 K**. $2\ NOBr(g) \rightleftharpoons 2\ NO(g) + Br_2(g)$ The **production** of **NO(g)** is **favored** by: Indicate **True (T)** or **False (F)** for each of the following: a) **Decreasing** the **temperature**. ______ b) **Decreasing** the **volume**. ______ c) **Adding Br$_2$**. ______ d) **Decreasing** the **pressure** (by changing the volume). ______
Question 7 **8 Points**	The equilibrium constant, **K_p**, for the following reaction is **0.110** at **298 K**. $NH_4HS(s) \rightleftharpoons NH_3(g) + H_2S(g)$ If **$\Delta H°$** for this reaction is **92.7 kJ**, what is **the value of K_p at 408 K**? **Must Show Work for Full Credit: R = 8.314 J.mol^{-1}.K^{-1}** **K_p** = ____________
Question 8 **9 Points**	a) What is the **conjugate acid** of **CO_3^{2-}** ______ b) What is the **conjugate base** of **HCO_3^-** ______ c) Write a **net ionic equation** to show that **methylamine** behaves as a **Brønsted-Lowry base** in water. $CH_3NH_2(aq) + H_2O(l)$ ______ ____________ + __________ **= or ⇔**
Question 9 **8 Points**	Indicate whether each of the following compounds will give an **acidic(A)**, **basic(B)** or **neutral(N)** solution when dissolved in water. **ammonium sulfate**: ______ **lithium nitrite**: ______ **sodium nitrate**: ______ **potassium cyanide**: ______

Question 10 9 Points	Calculate the **pH** of a **0.369 M** aqueous solution of **CH_3COOH, K_a = 1.8x10^{-5}** @25°C. **For <u>Full Credit</u> must fill in the <u>ICE Table</u> and <u>Show Work</u>.**

		+				+	
I							
C							
E							

pH = ____________

Question 11 9 Points	Calculate the **pH** of a **0.401 M** aqueous solution of **C_9H_7N, K_b = 6.30x10^{-10}** @25°C. **For <u>Full Credit</u> must fill in the <u>ICE Table</u> and <u>Show Work</u>.**

		+				+	
I							
C							
E							

pH = ____________

Question 12 6 Points	What is the **pOH** of an aqueous solution of **0.102 M hydrobromic acid**?

pOH = ____________

Question 13
9 Points

In the laboratory, a general chemistry student measured the **pH** of a **0.312 M** aqueous solution of **nitrous acid** to be **1.854**. What is the **Ka** for **HNO_2**?

For _Full Credit_ must fill in the _ICE Table_ and _Show Work_.

		+				+	
I							
C							
E							

K_a = ______________

Do Not Write Below This Line

Exam II Score	