The Periodic Table

IA																	VIIIA
H 1 1.01	IIA											IIIA	IVA	VA	VIA	VIIA	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	IIIB	IVB	VB	VIB	VIIB	VIIIB	VIIIB	VIIIB	IB	IIB	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 Formulae and Constants:

$$pH = pK_a + \log_{10}\{[A^-]/[HA]\}$$

$$K_w = 1\times10^{-14} \text{ @ } 25°C$$

Question 1
8 Points

Consider the following system at equilibrium at 298 K:

$$N_2(g) + O_2(g) + 43.2 \text{ kcal} \Leftrightarrow 2 NO(g)$$
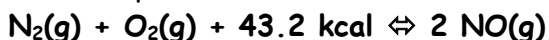
The **production** of **NO(g)** is **favored by**:

Indicate **True** or **False** for each of the following:

❑ **Increasing** the temperature. _____ ❑ **Adding NO**. _____

❑ **Increasing** the volume. _____ ❑ **Removing** O_2. _____

Question 2
8 Points

Consider the following system at equilibrium at 346 K:

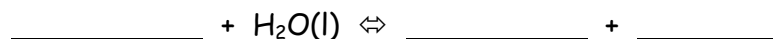$$CO(g) + Br_2(g) \Leftrightarrow COBr_2(g) + 18.2 \text{ kcal}$$

The **production** of **$COBr_2(g)$** is **favored by**:

Indicate **True** or **False** for each of the following:

❑ **Decreasing** the temperature. _____ ❑ **Adding** Br_2. _____

❑ **Decreasing** the pressure. _____ ❑ **Removing** $CoBr_2$. _____

Question 3
4 Points

Write a net ionic equation to show that hydrofluoric acid, **HF**, behaves as an **acid** in **water**.

_____ + $H_2O(l)$ $\Leftrightarrow$ _____ + _____

Question 4
8 Points

Assign each species on the **left** to a **category** on the **right**.

a. $C_2H_5NH_2$ _____ **1.** Strong Acid

b. **HF** _____ **2.** Weak Acid

c. NH_3 _____ **3.** Strong Base

d. $Ba(OH)_2$ _____ **4.** Weak Base

Question 5
6 Points

The **hydroxide** concentration in an aqueous solution is 4.47×10^{-4} M @ 25°C

a. The **hydronium** ion concentration is: _____ M

b. The **pH** of this solution is: _____

c. The **pOH** is: _____

Question 6
6 Points

Arrange the following solutions in order of increasing acidity:

1 = least acidic ; 3 = most acidic

1. $[H_3O^+] = 1 \times 10^{-6}$ M _____

2. pOH = 3 _____

3. $[OH^-] = 1 \times 10^{-9}$ M _____

Question 7
8 Points

In the following **net ionic equation**, identify **each reactant** as either a **Bronsted-Lowry acid** or a **Bronsted-Lowry base**:

$$CH_3CO_2H(aq) + H_2O(l) \Leftrightarrow CH_3CO_2^- + H_3O^+$$

Bronsted-Lowry acid: BLA

1. CH_3CO_2H _____

2. H_2O _____

Bronsted-Lowry base: BLB

3. $CH_3CO_2^-$ _____

4. H_3O^+ _____

Question 8
6 Points

Give the formula for:

1. The **conjugate acid** of $H_2PO_4^-$ _____

2. The **conjugate base** of $H_2PO_4^-$ _____

Question 9
4 Points

Which of the following aqueous solutions are buffer solutions?

❑ 0.19 M KOH + 0.25 M KCl

❑ 0.34 M NH4Br + 0.38 M NH_3

❑ 0.34 M $Ba(ClO_4)_2$ + 0.23 M $Ba(NO_3)_2$

❑ 0.17 M CH_3COOH + 0.17 M CH_3COOK

❑ 0.22 M HI + 0.19 M NaI

Question 10
4 Points

A buffer solution that is 0.354 M in HNO_2 and 0.354 M in $NaNO_2$ has a **pH of 3.35**.

Addition of **which of the following** would **increase the capacity** of the buffer for added H_3O^+?

❑ $NaNO_2$

❑ pure water

❑ HNO_2

❑ both HNO_2 and $NaNO_2$

❑ None of the these

Question 11
5 Points

A buffer solution is **0.422 M** in **HCN** and **0.273 M** in **KCN**. If **Ka** for HCN is **4.0x10⁻¹⁰**, what is the pH of this buffer solution?

pH = [_____]

Question 12
8 Points

A small amount of **strong base** is added to a **buffer** made from HNO_2 and $NaNO_2$. What changes if any will occur to the solution?

- Circle the appropriate answer

a. **pH**	Increase	Decrease	Unchanged
b. **[NO₂⁻]**	Increase	Decrease	Unchanged
c. **[HNO₂]**	Increase	Decrease	Unchanged
d. **[OH⁻]**	Increase	Decrease	Unchanged

Question 13
6 Points

How many grams of copper(II) chloride are there in **48.9 mL** of an aqueous solution that has a concentration of **0.196 M** ?

Must show work

[   ] g

Question 14
6 Points

You wish to make a **0.233 M nitric acid** solution from a stock solution of **6.00 M nitric acid**. How much concentrated acid must you add to obtain a total volume of **75.0** mL of the dilute solution ?

Must show work

[   ] mL

Question 15
5 Points

According to the following reaction, how many moles of **bromine trifluoride** are necessary to form **0.162** moles **fluorine gas**?   bromine trifluoride (g) = bromine (g) + fluorine (g)

Must show work and include a balanced chemical equation.

[   ] mol

Question 16

8 Points

An aqueous solution of **barium hydroxide** is standardized by titration with a **0.264 M** solution of **nitric acid.**

If **23.6** mL of base are required to neutralize **23.3** mL of the acid, what is the molarity of the **barium hydroxide** solution?

Must show work and include a balanced chemical equation.

M