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 Formulae and Constants:

$$pH = pKa + \log_{10} \frac{[Base]}{[Acid]}$$

$25^0C = 298K$

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

$R = 0.08205\ L.atm.K^{-1}.mol^{-1}$

SID | | | | | | | | | Last _____ First _____

Question 1 (6 Points)

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

$HClO_4(aq) + H_2O(l)$ _____ _____ + _____

(= or ⇔)

b. Write a **net ionic equation** to show how **ammonia** behaves as a base in water.

$NH_3(aq) + H_2O(l)$ _____ _____ + _____

(= or ⇔)

Question 2 (8 Points)

a. HNO_2 _____

b. C_9H_7N _____

c. CH_3COOH _____

d. $Ba(OH)_2$ _____

1. Strong Acid

2. Weak Acid

3. Strong Base

4. Weak Base

Question 3 (6 Points) Circle the appropriate answers

	Acid	K_a
A	Acetic	$1.8x10^{-5}$
B	Histidine	$7.9x10^{-7}$
C	Carbonic	$4.2x10^{-7}$

a. The acid with the **smallest [H_3O^+]** in a **0.10** M aqueous solution is: **A B C**

b. The acid with the **smallest pKa**: **A B C**

c. The acid with the **smallest pOH** in a 0.10 M aqueous solution is: **A B C**

Question 4 (4 Points) A student determines that the value of **pKa** for HCN = **9.29** .

What is the value of **Ka**? _____

Question 5 (9 Points) The **hydroxide** concentration in an aqueous solution is **$3.5x10^{-2}$** M.

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

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

c. The **pOH** is: _____

Question 6 (6 Points)

1. For following net ionic equation:

$CN^-(aq) + HSO_3^-(aq) \Leftrightarrow HCN(aq) + SO_3^{2-}(aq)$

– Circle the appropriate answer – B-L = Bronsted Lowry

SO_3^{2-}	B-L Acid	B-L Base
HSO_3^-	B-L Acid	B-L Base

2. The formula for the conjugate _____ of **CN^-** is: _____

3. The formula for the conjugate _____ of **HSO_3^-** is: _____

Question 7
6 Points

A buffer solution that is **0.436M** in **HCN** and **0.436M** in **KCN** has a pH of **9.40**.

Addition of **which of the following** would **increase the capacity of the buffer** for added **OH^-**?

- ☐ KCN
- ☐ HCN
- ☐ both HCN and KCN
- ☐ pure water
- ☐ none of these choices

Question 8
5 Points

Which of the following aqueous solutions are buffer solutions ?

- ☐ 0.24 M HI + 0.18 M NaI
- ☐ 0.10 M CH_3COOH + 0.18 M CH_3COOK
- ☐ 0.27 M NH_4Br + 0.31 M NH_3
- ☐ 0.34 M NH_4NO_3 + 0.39 M $NaNO_3$
- ☐ 0.10 M HCl + 0.21 M NaF

Question 9
6 Points

A buffer solution is made that is **0.434M** in **HF** and **0.434M** in **KF**

1. If **Ka** for HF is **$7.2x10^{-4}$**, what is the pH of the buffer solution? _____
2. Write the net ionic equation for the reaction that occurs when **0.129** mol **HCl** is added to 1.00 L of the buffer solution.

_____ + _____ = _____ + _____

Question 10
5 Points

A buffer solution is **0.414M** in **H_2CO_3** and **0.324M** in **$KHCO_3$**. If Ka for **H_2CO_3** is **$4.2x10^{-7}$**, what is the pH of this buffer solution?
Must show work

pH = _____

Question 11
8 Points

A small amount of **strong base** is added to a **buffer** made from **HCN** and **NaCN**. What changes if any will occur to the following.

Choose from the following choices:

Increase significantly	**Increase**	**Increase slightly**
Decrease significantly	**Decrease**	**Decrease slightly**

1. **pH** _____
2. **[OH^-]** _____
3. **[HCN]** _____
4. **[CN^-]** _____

Question 12
6 Points

When the nuclide **^{218}Po** decays to **^{214}Pb**, what kind of decay does **^{218}Po** undergo? _____. The instability of **^{218}Po** is probably due to the fact that it has too many _____.

Question 13
6 Points

Write a balanced nuclear equation for the following:

- **$^{59}_{26}Fe$** undergoing beta decay: _____ = _____
- **$^{25}_{13}Al$** undergoing positron emission: _____ = _____
- **$^{41}_{20}Ca$** undergoing electron capture: _____ = _____

Question 14
6 Points

What **volume** of **hydrogen gas** is produced when **1.33** mol of **iron** reacts completely according to the following reaction at **25°C** and **1 atm**?

iron (s) + hydrochloric acid (aq) = iron(II) chloride (aq) + hydrogen (g)

For full credit you must show work and include a balanced chemical equation.

_____ **L**

Question 15
8 Points

An aqueous solution of **hydrochloric acid** is standardized by titration with a **0.453** M solution of **barium hydroxide**.
If **29.4** mL of base are required to neutralize **15.6** mL of the acid, what is the **molarity** of the **hydrochloric acid** solution?
For full credit you must show work and include a balanced chemical equation.

_____ **M**

Question 16
5 Points

How many **grams** of **iron(II) bromide** are there in **43.5**mL of an aqueous solution that has a concentration of **0.166**M ?
Must show work

_____ **grams**

Exam III Score _____