CHM 152 Q7 25 Pts Fall 2005 *Student:* _____

DO ON SEPARATE PAPER IN NEAT FORM. Key

****DUE October 19, 2005****

1. The English are fond of soggy French fries ("chips") wrapped in old newspaper and generously drenched in vinegar, which is a 0.83 *M* solution of acetic acid. If the acetic acid in vinegar is 0.47% dissociated, calculate K_a for this acid.

2. Describe what is meant by the "leveling effect". Use a real acid as an example, and write an appropriate equation.

3. Consider the reaction:

   $BF_3 + F^- \rightarrow BF_4^-$

   Can this ever be considered to be an acid-base reaction? Support your answer with appropriate arguments.

4. Formic acid, which is a component of insect venom, has a $K_a = 1.8 \times 10^{-4}$. What is the $[H_3O^+]$ in a solution that is initially 0.10 *M* formic acid, HCOOH?

5. Picric acid has been used in the leather industry and in etching copper. However, its laboratory use has been restricted because it dehydrates on standing and can become shock sensitive. It has an acid dissociation constant of 0.42. What is the $[H_3O^+]$ for a 0.20 *M* solution of picric acid?

6. What is the pH of a 0.050 *M* triethylamine, $(C_2H_5)_3N$, solution?
   K_b for triethylamine is 5.3×10^{-4}.

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#1 $CH_3C_2OOH = HOAc$

$$K_a = \frac{[H_3O^+][OAc^-]}{[HOAc]}$$

$$K_a = \frac{[0.003901]^2}{0.83 - 0.003901}$$

$$K_a = 1.84 \times 10^{-5}$$

	H_2O +	$HOAc$ ⇌	H_3O^+ +	OAc^-
I	NA	0.83	0	0
C		$-x$	$+x$	$+x$
E		$0.83-x$	x	x

$X = 0.0047 \times 0.83 = 0.003901$

#2 $-e + H_2O \rightleftharpoons H_3O^+ + e^-$

In water the strongest acid that can exist is H_3O^+ and the strongest base is OH^-.

#3 $BF_3 + F^- \rightarrow BF_4^-$

$3 \times 7 = 21$

$1 \times 3 = 3$

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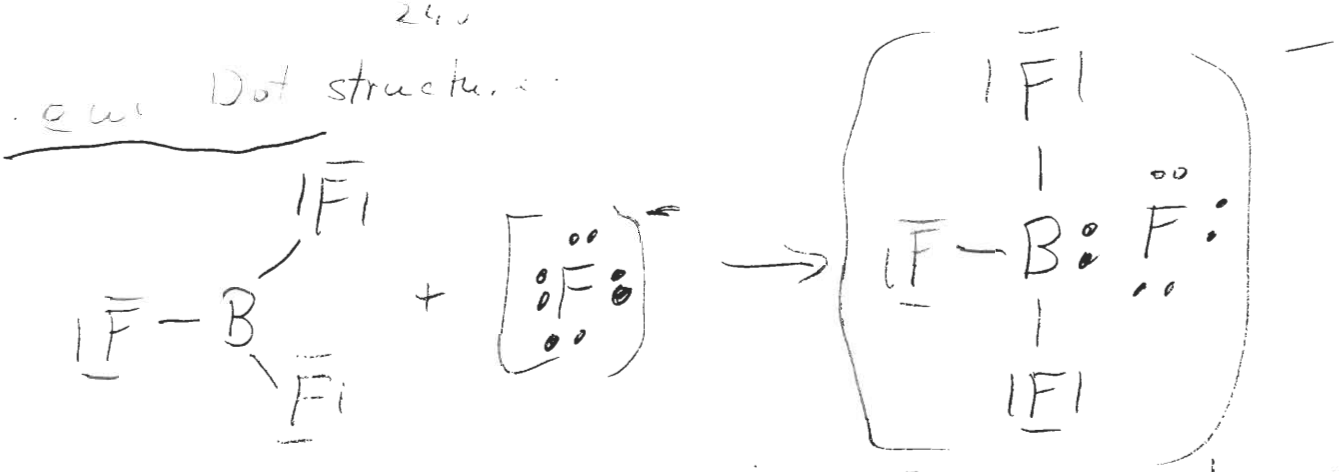
Lewis Dot structure



F^- Donates e⁻ pair — Lewis Base

BF_3 accepts e⁻ pair — Lewis Acid

#4)

$$HCOOH + H_2O \rightleftharpoons H_3O^+ + HCOO^-$$

	$HCOOH$	H_2O	H_3O^+	$HCOO^-$
I	0.10	NA	0	0
C	$-x$		$+x$	$+x$
E	$0.10-x$		x	x

$$K_a = \frac{[H_3O^+][HCOO^-]}{[HCOOH]}$$

$$8\times10^{-4} = \frac{x^2}{0.10-x}$$

$$x = 0.0042\ M\ H_3O^+$$

#5) $(NO_2)_3C_6H_2OH = Hpic$

$$Hpic + H_2O \rightleftharpoons H_3O^+ + pic^-$$

	$Hpic$	H_2O	H_3O^+	pic^-
I	0.20	NA	0	0
C	$-x$		$+x$	$+x$
E	$0.20-x$		x	x

$$K_a = \frac{[H_3O^+][pic^-]}{[Hpic]}$$

$$0.42 = \frac{x^2}{0.20-x}$$

must use quad. eq.

$$0.084 - 0.42x = x^2$$

$$x^2 + 0.42x - 0.084 = 0$$

$$x = \frac{-0.42 \pm \sqrt{0.42^2 - 4(1)(-0.084)}}{2(1)}$$

$$x = 0.148$$

$$[H_3O^+] = 0.15\ M$$

#6

$$(C_2H_5)_3N: + H_2O \rightleftharpoons (C_2H_5)_3N:H^+ + OH^-$$

Lewis Base Lewis Acid

I.	0.050	NA	0	0
C.	$-x$		$+x$	$+x$
E.	$0.050-x$		x	x

$$K_b = \frac{[(C_2H_5)_3NH^+][OH^-]}{[(C_2H_5)_3N]}$$

$$5.3 \times 10^{-4} \quad \frac{x^2}{0.050-x}$$

$x = 0.00514 = (OH^-)$

$pOH = 2.28$

$pH \quad 11.71$