Exam Wednesday Night

Place

UTC 2.102A Last name A-K

UTC 2.112A Last name L-Z

Time

7:30-9:00

We will start right at 7:30

We will end right at 9:00

get there early

Makeup Exam Sunday night

Place
TBD

Time
6:30-8:00

Anyone who would like to can take the makeup exam

You cannot take both

When are you planning to take the exam

A. Wednesday night

B. Sunday night

Converting pH and pOH

$$K_w = [H^+][OH^-]$$
$$\log(K_w) = \log([H^+][OH^-])$$
$$\log(K_w) = \log[H^+] + \log[OH^-]$$

$$\log(10^{-14}) = \log[H^+] + \log[OH^-]$$
$$-14 = -pH - pOH$$
$$14 = pH + pOH$$

For the next exam

Which of the following would be more helpful

A. More worksheets
B. Suggested back of the book problems
C. Suggested problems on eduspace
D. other

Buffer   Both HA and A-

$$HA(aq) \longrightarrow H^+(aq) + A^-(aq)$$

	HA	H^+	A^-
I	$[HA]_0$	0 (← really 10^{-7})	$[A^-]_0$
C	$-x$	$+x$	$+x$
E	$[HA]_0 - x$	$+x$	$[A^-]_0 + x$

$$K_a = \frac{[H^+][A^-]}{[HA]} = \frac{(x)([A^-]_0+x)}{[HA]_0 - x} = \frac{(x)([A^-]_0)}{[HA]_0}$$ assuming $x << C$

pH in a buffer solution

$$K_a \approx \frac{[H^+][A^-]_0}{[HA]_0}$$

we have approximated a small change

$$\log(K_a) \approx \log \frac{[H^+][A^-]_0}{[HA]_0} = \log[H^+] + \log \frac{[A^-]_0}{[HA]_0}$$

$$pKa = pH - \log \frac{[A^-]_0}{[HA]_0}$$

initial conjugate base

$$pKa = pH - \log \frac{[A^-]_0}{[HA]_0}$$

initial weak acid

$[A^-]_0 = [HA]_0$	$[A^-]_0 < [HA]_0$	$[A^-]_0 > [HA]_0$
equal acid/base	more acid	more base
$-\log \frac{[A^-]_0}{[HA]_0} = 0$	$-\log \frac{[A^-]_0}{[HA]_0} > 0$	$-\log \frac{[A^-]_0}{[HA]_0} < 0$
$pH = pKa$	$pH < pKa$	$pH > pKa$

What is the pOH of a 0.01M solution of $HClO_4$?

A. 1

B. 2

C. 7

D. 10

E. 12 ⟵ $[H^+] = 10^{-2}$ pH = 2 pOH = 12

Strong Acids and Bases

"Strong" means one thing

The substance dissociates 100% in water

Strong Acid

$HCl(aq) \longrightarrow H^+(aq) + Cl^-(aq)$

$$K_a = \frac{[H^+][Cl^-]}{[HCl]} \approx \infty$$

Strong Electrolyte

$NaCl(s) \longrightarrow Na^+(aq) + Cl^-(aq)$

$$K_{sp} = [Na^+][Cl^-] \approx \infty$$

What is the pH of a 10^{-10}M solution of HCl?

A. 2

B. 4

C. 7

D. 10

E. very slightly less than 7

When do we get into problems with approximations

What approximations are we making

Typically that $[H^+]_0 = 0$
no H^+ at the start

not a problem along as the concentration of acid or base is large enough

what is large enough big compared to 10^{-7}

When do we get into problems with approximations

What approximations are we making

That the change is small
what is required for this

K should be small (weak acid, weak base)
The initial concentration should be large

C-x is approximately C
this is a comparison between C and x

For which of this will our approximations fail?

A. 0.1 M solution of sodium acetate

B. 1 M solution of HF

C. 10^{-6} M solution of benzoic acid

D. 0.5 M solution of HCl

E. 0.2 M solution of NaOH

The pK_a of HF is 3.18. What is the pH of solution of 100 mL of 0.1 M HF and 100 mL of a 0.2 M NaF?

A. slightly less than 3.18

B. 3.18

C. slightly more than 3.18

initial conjugate base

$$pKa = pH - \log \frac{[A^-]_0}{[HA]_0}$$

initial weak acid

if the initial acid and base are similar in concentration than the pH is close to the pKa

For the pH to be 1 unit different than the pKa the difference in concentrations must be at least 10 X!