LM 19
LM 20.
NGLM 101 - bonus pts. Im Participation.

1/19/13

Quiz 1) Which of following is not strong acid?

a) HF

2) Which of following not strong base?

D. $Mg(OH)_2$. not soluble in H_2O.

3) Which of following not match?

Ammonia NH_3 ← memorize.

Perchloric acid $HClO_3$ | $HClO_4$

Nitric acid HNO_3

sulfuric H_2SO_4

hydrobromic HBr

a HCl & CH_3COOH solutions both turned yellow when indicator was added. Very diff. chemical structures? why?

acid - proton donor

base - proton acceptor

4) Which reactant behaving like a base?

$CN^-(aq) + H_2O(l) \rightleftharpoons HCN(aq) + OH^-(aq)$.

(D) CN^-.

5) What is conjugate base of HCOOH?

What is conjugate acid of HPO_4^{2-}

(C) $HCOO^-$, $H_2PO_4^{2-}$

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

$HPO_4^{2-} + H_2O \rightarrow H_2PO_4^- + OH^-$

Review. 1st label reactants as acid or base.

2nd label as conjugate acid or base

derivative of NH_3 (base) $CH_3NH_2(aq) + H_2O(l) \rightleftharpoons CH_3NH_3^+(aq) + OH^-$

(acid)

$CH_3NH_2(aq) + H_2O(\ell) \rightleftharpoons CH_3NH_3^+ + OH^-$

Base — acid — conj. acid — conj. base.

Part II

2) $HClO_2 + H_2O(\ell) \rightleftharpoons ClO_2^- + H_3O^+$

acid — base — conj. base — conj. acid

$K_a = \dfrac{[ClO_2^-][H_3O]}{[HClO_2]}$ Stronger acid strength → bigger K_a.

Poll: The acids in 1st data table are listed:

(B.) In order of ↓ acid strength.

Poll: After examining K_a & K_b the inferred relationship between the strength of acid & bases.

(B.) The stronger acid → weaker conjugate base partner.

Part 3:

$K_a = [H_3O] + [OH]$

$K_a = \dfrac{[ClO_2][H_3O]}{[HClO_2]}$ $HClO_2(aq) + H_2O(\ell) \rightleftharpoons ClO_2^- H_3O^+$

$ClO_2^- + H_2O(\ell) \rightleftharpoons HClO_2 + OH^-$ $K_b = \dfrac{[HClO_2][OH^-]}{[ClO_2]}$

$+ \quad H_2O + H_2O \rightleftharpoons H_3O + OH$

$K_a \cdot K_b =$

If adding different K you multiply it.

$\dfrac{[ClO_2][H_3O]}{[HClO_2]} \cdot \dfrac{[HClO_2][OH^-]}{[ClO_2]} = [H_3O][OH^-]$ K_w ↓

any
Multiplying conjugate acid base partners the product is K_w.

$K_w = [H_3O][OH^-]$

1.2×10^{-2} 8.3×10^{-13}.

1×10^{-14}.

Auto-ionization of water.

$K_w = [H_3O^+][OH^-] = 1\times10^{-14}$.

In pure water you always have a little bit of H_3O & OH.

- If Equal amounts. = neutral.
- If more hydronium = acidic, toward reactants., shift left
- If more hydroxide = basic., toward reactants. shift left.

→ K_w small so reactant favored.

Add HCl → dissociates.

Add H_3O^+ → OH ↓

Add OH^- → H_3O^- ↓

a: Calculate $[H_3O]^+$ & $[OH]$.

Determine the $[H_3O]^+$ & $[OH]$ @ 25°C 6.0×10^{-2}M HI(aq).

HI → strong acid. dissociate fully.

$HI + H_2O \Rightarrow H_3O^+ + I^-$

$[H_3O^+] = 6.0\times10^{-2}$M. (strong acid, ionization)

Split apart so same.

$[OH] = ?$

$K_w = [H_3O^+][OH]$

$1\times10^{-14} = [6.0\times10^{-2}\,M][OH]$

$[OH] = \boxed{1.66\times10^{-13}}$

Acid.

q Determine the $[H_3O]^+$ & $[OH]$ in 6.0×10^{-2} M NH_4

NH_3 weak base ← weak base.

NH_4 conj. acid. ← weak acid

Some bases weaker than other.

R. $NH_4^+ + H_2O \iff NH_3 + H_3O^+$

I $K_a = \frac{[NH_3][H_3O]}{[NH_4]}$

I. $6.0 \times 10^{-2} + 0 \iff$ some. + some.

C $-x \quad x \quad +x$

E. $6.0 \times 10^{-2} - x \iff x + x$

$K_a = \frac{[x][x]}{6.0 \times 10^{-2} - x}$

$K_a \cdot K_b = 1.0 \times 10^{-14}$

$5.6 \times 10^{-10} = \frac{x^2}{6 \times 10^{-2}}$

$x = 5.8 \times 10^{-6} [H_3O]$

$x = 1.725 \times 10^{-9} [OH]$

Express degree of acidity using pH & degree of basicity using pOH.

$pH = -\log [H_3O^+]$

Calculate pH of 6×10^{-5} M $HClO_4$ perchloric.

R $HClO_4 + H_2O(l) \rightarrow ClO_4^- + H_3O^+$

$[H_3O^+] = 6 \times 10^{-5}$

$\boxed{pH = 4.2}$

Calculate pOH of .077M NaOH

$pOH = -\log [0.077]M$ $\boxed{pOH = 1.11}$