Question 20

$$2\,HCl(g) \longleftrightarrow H_2(g) + Cl_2(g)$$

5/16 Homework Answers:

1. G
2. C
3. H
4. J
5. E
6. F
7. I
8. D
9. B
10. A
11. sulfuric acid
12. sodium hydroxide
13. ammonia
14. hydrochloric acid
15. potassium hydroxide
16. nitric acid

Arrhenius:
Acid - increases H^+ ions
Base - increases OH^- ions

Bronsted-Lowry:
Acid - proton donor
Base - proton acceptor

Conjugate Pair: the acid/base that share a proton.

lost

$HCl(aq) + NH_3(aq) \leftrightarrow Cl^- + NH_4^+$

gained

Pair 1 acid: HCl base: Cl^-

Pair 2 acid: NH_4^+ base: NH_3

10+ LeChatlier's Unit

$$K_{water} = [H_3O^+][OH^-] = 1.0 \times 10^{-14}$$

Pure H_2O:

$[H_3O^+] = 1.0 \times 10^{-7} M$

$[OH^-] = 1.0 \times 10^{-7} M$

Based on what is being added to water you will calculate $[H_3O^+]$ or $[OH^-]$.

$1.0 \times 10^{-14} = (1 \times 10^{-5} M)[OH^-]$

$[OH^-] = 1.0 \times 10^{-9} M$

pH = ?

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

pH = 5

$1.0 \times 10^{-14} = [H_3O^+][OH^-]$

$1.0 \times 10^{-14} = [H_3O^+](1 \times 10^{-3} M)$

0.0010

$[H_3O^+] = 1.0 \times 10^{-11} M$ pH = 11

#3. 1st 0.080g NaOH → moles

2nd $\frac{\text{moles}}{L}$ → M (this is $[OH^-]$)

3rd find $[H_3O^+]$ by using

$$0.080\text{g NaOH} \times \frac{1\text{ mol}}{40.01\text{ g}} = 1.9995 \times 10^{-3}\text{ mol} \quad \text{(molar mass)}$$

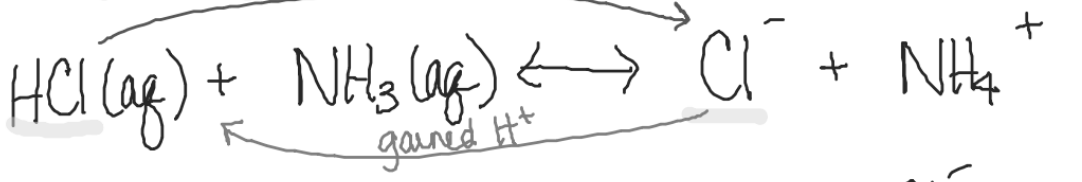
$$\frac{1.9995 \times 10^{-3}\text{ mol}}{2.0\text{ L}} = 1.0 \times 10^{-4}\text{ M} \quad [OH^-]$$

$$1.0 \times 10^{-14} = [H_3O^+](1.0 \times 10^{-4}\text{ M})$$

$$[H_3O^+] = 1.0 \times 10^{-10}\text{ M}$$

$$pH = 10$$

Conjugate Acid/Base: The acid/base pair that share a proton (hydroxide)



Pair 1 acid: HCl base: Cl^-

Pair 2 acid: NH_4^+ base: NH_3

$HC_2H_3O_2(aq) + H_2O(aq) \leftrightarrow C_2H_3O_2^- + H_3O^+$

Pair 1 acid: $HC_2H_3O_2$ base: $C_2H_3O_2^-$

Pair 2 acid: H_3O^+ (hydronium) base: H_2O

amphoteric

Calculating pH (actually pH_3O^+) ☺

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

what is the pH if $[H_3O^+] = 1.0 \times 10^{-5} M$

$pH = -\log[1.0 \times 10^{-5} M]$

$pH = 5$

$1.0 \times 10^{-14} = [H_3O^+][OH^-]$ pure water

K_{water}

$1.0 \times 10^{-14} = [H_3O^+](1.0 \times 10^{-3} M)$

$[H_3O^+] = 1.0 \times 10^{-11} M$ $pH = 11$

(-) log (1.0 EE (-) 11)

$[H_3O^+] = ?$ $[OH^-] = 0.0010M$ $1.0 \times 10^{-3} M$

$1.0 \times 10^{-14} = [H_3O^+](1.0 \times 10^{-3} M)$

$\frac{1.0 \times 10^{-14}}{1.0 \times 10^{-3} M} = [H_3O^+] = 1.0 \times 10^{-11} M$ $pH = 11$

$-14 - -3 = -11$

1st grams → moles

2nd $M = \frac{moles}{L}$

3rd ↳ calculate missing piece $1.0 \times 10^{-14} = [H_3O^+][OH^-]$

$0.080g\ NaOH \times \frac{1\ mol}{40.01g} = \frac{1.9995 \times 10^{-4} mol}{2.0L} = 1.0 \times 10^{-4} M\ [OH^-]$

$1.0 \times 10^{-14} = [H_3O^+](1.0 \times 10^{-4} M)$ $[H_3O^+] = 1.0 \times 10^{-10} M$

$pH = 10$