This is ACA # 18. It is OK to use your textbook, but if you can answers the questions without it that is OK too.

I recommend you print out this page and bring it to class. Click here to show a set of five ACA18 student responses, randomly selected from all of the student responses thus far, in a new window.

John , here are your responses to the ACA and the Expert's response.

I recommend having a copy of the Arrhenius Acid DCI in front of you as you are doing this ACA.

1. The chemical equation that describes how HCl(aq) behaves as an Arrhenius acid is

$$HCl(aq) \rightleftarrows H^{+}(aq) + Cl^{-}(aq)$$

For each of the following acids write the Arrhenius equation that describes its acidic character. (NOTE: It is a little difficult to represent the equilibrium arrow online so using a ---> (three '-' dashes and a '>' greater than character is fine. Just remember for weak acids the equilibrium symbol is best for representing the reaction arrow.)

a) $HNO_3(aq)$

HNO3(aq) --> H^+(aq) + NO3^-(aq) 86%

leave off charge no pts

$HNO_3(aq) \text{ ---> } H^{+}(aq) + NO_3^{-}(aq)$

It is a little difficult to represent the equilibrium arrow online so using a ---> (three '-' dashes and a '>' greater than character is fine. Just remember for weak acids the equilibrium symbol is best for representing the reaction arrow.)

$HA_{(aq)} \rightleftarrows H^{+}_{(aq)} + A^{-}$

b) $HC_2H_3O_2(aq)$

HC2H3O2(aq) --> H^+(aq) + C2H3O2^-(aq) 77%

H^{+} & whatever remains^{-}

$HC_2H_3O_2(aq)$ $H^{+}(aq) + C_2H_3O_2^{-}(aq)$

c) $H_2CO_3(aq)$

H2CO3(aq) --> H^+(aq) + HCO3^-(aq) 60%

$H_2CO_3(aq) \rightleftarrows H^+(aq) + HCO_3^-(aq)$

only SA completely dissociate

acids dissociate one H^+ at a time

NOTE: Even though H_2CO_3 is a diprotic acid (it has two ionizable hydrogens) when writing the chemical equation that describes how H_2CO_3 behaves as an acid we only remove one hydrogen ion. This is the case for ALL polyprotic acids.

2. The chemical equation that describes how NaOH(aq) behaves as an Arrhenius base is

$$NaOH(aq) \rightleftarrows Na^+(aq) + OH^-(aq)$$

For each of the following bases write the Arrhenius equation that describes its basic character.

a) KOH(aq)

KOH(aq) --> K^+(aq) + OH^-(aq) 86%

leave off charge no pts

$KOH(aq) \longrightarrow K^+(aq) + OH^-(aq)$

b) $Ba(OH)_2(aq)$

Ba(OH)2(aq) --> Ba^2+(aq) + 2OH^-(aq) 50%

$Ba(OH)_2(aq) \longrightarrow Ba^{2+}(aq) + 2OH^-(aq)$

show ST

charges!! subscripts!! coefficients

3. Complete the following table by calculating the value of the missing entry. (NOTE: To express a number in scientific notation 1.00×10^{-7}, enter the value as 1.00e-7.)

$[H^+]$	$[OH^-]$	pH	pOH
2.50×10^{-3} M	4e-12 M 4.00×10^{-12} M 77%	2.60 2.60 82%	11.40 11.40 68%

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

$1\times10^{-14} = 2.5\times10^{-3}[^-OH]$

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

calc pH from $[H^+]$

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

calc $[H^+]$ from pH

$10^{-pH} = 10^{\log[H^+]}$

$10^{-pH} = [H^+]$

$pH = -\log(2.5\times10^{-3})$

$= -\log 2.5 + (-\log 10^{-3})$

$pH = 8.65$

$= \quad [H^+] = \_\_ \times 10$

$\frac{1\times10^{-14}}{2.5\times10^{-3}} = \quad \times 10^{-11}$

1.07e-10 M 1.07×10^{-10} M 73%	9.32×10^{-5} M	9.97 9.97 73% DNR	4.03 4.03 82%
1.25e-3 M 1.25×10^{-3} M 64%	7.94e-12 M 7.94×10^{-12} M 68%	2.9 2.90 73%	11.10
1.78e-5 M 1.78×10^{-5} M 78%	5.6e-10 M 5.62×10^{-10} M 59%	4.75	9.25 9.25 73%

In the first row the $[H^+] = 2.50 \times 10^{-3}$ M

to calculate the $[OH^-]$ we use the equilibrium expression for water

$$K_w = 1.00 \times 10^{-14} = [H^+][OH^-]$$

$1.00 \times 10^{-14} = [H^+][OH^-]$

substitute $[H^+] = 2.50 \times 10^{-3}$ M and solve for $[OH^-]$

$1.00 \times 10^{-14} = 2.50 \times 10^{-3}$ M$[OH^-]$

$[OH^-] = 2.50 \times 10^{-3}$ M$/1.00 \times 10^{-14} = 4.00 \times 10^{-12}$ M

To calculate the pH of the solution

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

$pH = - \log (2.50 \times 10^{-3}) = 2.60$

To calculate the pOH of the solution

$14 = pH + pOH$ or $pOH = -\log [OH^-]$

$14 = pH + pOH = 2.60 + pOH$

$pOH = 14 - 2.60 = 11.40$

or

$pOH = - \log (4.00 \times 10^{-12}) = 11.40$

The calculation in the second row are similar.

In the third row we need to be able to do an antilog. We are given the pH and we must calculate the $[H^+]$. Since

$pOH = -\log[OH^-]$

$11.10 = -\log[OH^-]$

We must first move the negative sign to the other side of the equal sign,

$-11.10 = \log[OH^-]$

raise each side to the power of 10

$10^{-11.10} = 10^{-\log[OH^-]}$

In our calculator use the 10^x function to calculate $10^{-11.10}$

$[OH^-] = 10^{-11.10} = 7.94 \times 10^{-12}$ M

The fourth row is calculated similar to the third row.

4. Is there anything about the questions that you feel you do not understand? List your concerns/questions.

nothing

5. If there is one question you would like to have answered in lecture, what would that question be?

nothing