CHM152/54 Quiz #5 25 Pts Fall 04 Name: Key

Show all setups.

1. (4 Pts) Complete and balance the following reactions:

a. $\underline{2}\ H_3PO_4(aq)$ + $\underline{3}\ Ba(OH)_2(aq)$ → $6\ H_2O\ (l)$ + $Ba_3(PO_4)_2\ (aq)$

b. ____ $H_2C_8H_4O_4(aq)$ + $\underline{2}\ NaOH(aq)$ → $2\ H_2O\ (l)$ + $Na_2C_8H_4O_4\ (aq)$

2. (12 Pts) Determine the pH, pOH, $[H^+]$, and $[OH^-]$ of each of the following:

a. A 0.0010 M HNO_3 solution strong acid

$[H^+] = 0.0010$ $[OH^-] = 10^{-14}/0.0010 = 1 \times 10^{-11}$

$pH = -\log 0.0010 = 3.00$ $pOH = 11.00$

b. A solution that is 2.9×10^{-2} M in HCl Strong Acid

$[H^+] = 2.9 \times 10^{-2}$ $[OH^-] = 10^{-14}/2.9 \times 10^{-2} = 3.45 \times 10^{-13}$

$pH = -\log 2.9 \times 10^{-2} = 1.537$ $pOH = 12.46$

c. A solution that contains 1.52 g of HNO_3 in 575 mL of solution.

$\frac{1.52\ g\ HNO_3}{} \Big| \frac{mol}{63.02\ g} \Big| \frac{}{575 \times 10^{-3}\ L} = 0.0419\ M\ HNO_3$

$[H^+] = 0.0419$ $pH = 1.38$ $[OH^-] = 2.29 \times 10^{-13}$ $pOH = 12.62$

d. A solution that is prepared by mixing 10.0 mL of 0.100 M HBr with 20.0 mL of 0.200 M HCl.

Both Strong Acids

$\left(\frac{10.0\ \cancel{mL}}{} \Big| \frac{0.100\ mol\ H^+}{1000\ \cancel{mL}} + \frac{20.0\ \cancel{mL}}{} \Big| \frac{0.200\ mol\ H^+}{1000\ \cancel{mL}}\right) \div 0.030\ L = 0.167\ M\ H^+$

$pH = 0.778$ $[OH^-] = 6 \times 10^{-14}$ $pOH = 13.22$

3. (9 Pts) Determine concentration of the excess reactant when 25.0 mL of 0.235 M nitric acid is reacted with 14.7 mL of 0.095 M of barium hydroxide. Then determine the pH of the resulting solution.

$2HNO_3\ (aq) + Ba(OH)_2\ (aq) \rightarrow 2\ H_2O\ (l) + Ba(NO_3)_2\ aq$

25.0 mL 14.7 mL

$\frac{0.235\ mol}{L}$ $\frac{0.095\ mol}{L}$

Find mole H^+: $\frac{25.0\ \cancel{mL}}{} \Big| \frac{0.235\ mol\ \cancel{HNO_3}}{1000\ \cancel{mL}} \Big| \frac{1\ mol\ H^+}{1\ \cancel{mol\ HNO_3}} = 0.005875\ mol\ H^+$

Find moles OH^-: $\frac{14.7\ \cancel{mL}}{} \Big| \frac{0.095\ mol\ Ba(OH)_2}{1000\ \cancel{mL}} \Big| \frac{2\ mol\ OH^-}{1\ mol\ Ba(OH)_2} = 0.002793\ mol\ OH^-$

subtraction gives mole of XS H^+: 0.003082 mol XS H^+

then $[H^+] = \frac{0.003082\ mol\ (H^+)}{39.7 \times 10^{-3}\ L} = 0.0776\ M\ H^+$ $pH = 1.11$