CALVIN

AP Chem Ch.15 Quiz **Name:** **Date:** **Hour:**

1) Calculate the $[H^+]$ in a solution that is 0.16 *M* in NaF and 0.25 *M* in HF. ($K_a = 7.2 \times 10^{-4}$)

A) 7.2×10^{-4} *M*
B) 1.6 *M*
C) 1.1×10^{-3} *M*
D) 0.20 *M*
E) 4.6×10^{-4} *M*

$HF \rightleftharpoons H^+ + F^-$

	HF	H^+	F^-
I	0.25	0	0.16
C	−x	+x	+x
E	0.25−x	x	0.16+x

$7.2\times10^{-4} = \frac{0.16x}{0.25}$ $x = \boxed{1.13\times10^{-3}\,M}$

2) Which of the following will not produce a buffered solution?

A) 100 mL of 0.1 *M* Na_2CO_3 and 50 mL of 0.1 *M* HCl
B) 100 mL of 0.1 *M* $NaHCO_3$ and 25 mL of 0.2 *M* HCl
C) 100 mL of 0.1 *M* Na_2CO_3 and 75 mL of 0.2 *M* HCl
D) 50 mL of 0.2 *M* Na_2CO_3 and 5 mL of 1.0 *M* HCl
E) 100 mL of 0.1 *M* Na_2CO_3 and 50 mL of 0.1 *M* NaOH

3) A weak acid, HF, is in solution with dissolved sodium fluoride, NaF. If HCl is added, which ion will react with the extra hydrogen ions from the HCl to keep the pH from changing?

A) OH^-
B) Na^+
C) F^-
D) Na^-
E) none of these

4) Which of the following is true for a buffered solution?

A) The solution resists change in its $[H^+]$.
B) The solution will not change its pH very much even if a concentrated acid is added.
C) The solution will not change its pH very much even if a strong base is added.
D) Any H^+ ions will react with a conjugate base of a weak acid already in solution.
E) All of these.

5) The following question refers to the following system: A 1.0-liter solution contains 0.25 *M* HF and 0.83 *M* NaF (K_a for HF is 7.2×10^{-4}).
What is the pH of this solution?

A) 3.14
B) 3.66
C) 2.62
D) 0.52
E) 10.34

	$HF \rightleftharpoons$	H^+	$+ F^-$
I	0.25M	0	0.83M
C	$-x$	$+x$	$+x$
E	$0.25-x$	x	$0.83+x$

$7.2\times10^{-4} = \frac{x(0.83)}{0.25}$ $\quad x = 2.17\times10^{-4}M$ $\quad pH = \boxed{3.66}$

6) Calculate the pH of a solution that is 0.50 *M* in HF ($K_a = 7.2 \times 10^{-4}$) and 0.95 *M* in NaF.

A) 3.14
B) 3.42
C) 0.28
D) 10.58
E) 2.86

	$HF \rightleftharpoons$	H^+	$+ F^-$
I	0.50M	0	0.95M
C	$-x$	$+x$	$+x$
E	$0.50-x$	x	$0.95+x$

$7.2\times10^{-4} = \frac{x(0.95)}{0.50}$ $\quad x = 3.79\times10^{-4}$ $\quad pH = \boxed{3.42}$

7) One milliliter (1.00 mL) of acid taken from a lead storage battery is pipetted into a flask. Water and phenolphthalein indicator are added, and the solution is titrated with 0.55 *M* NaOH until a pink color appears; 12.0 mL are required. The number of grams of H_2SO_4 (formula weight = 98) present in one liter of the battery acid is:

A) 647
B) 323
C) 30
D) 1294
E) 54

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

6.6×10^{-3} mol

$6.6\times10^{-3}\ \text{mol NaOH} \left| \frac{1\ \text{mol } H_2SO_4}{2\ \text{mol NaOH}} \right. = \frac{3.3\times10^{-3}\ \text{mol}}{1\times10^{-3}\ L} = 3.3M\ H_2SO_4$

$M = \frac{n}{L}$ $\quad n = \left(3.3\ \frac{mol}{L}\right)(1.00\ L) = 3.3 mol\ H_2SO_4$

$3.3\ \text{mol } H_2SO_4 \left| \frac{98\ g\ H_2SO_4}{1\ \text{mol } H_2SO_4} \right. = \boxed{323 g\ H_2SO_4}$

8) What is the molarity of a sodium hydroxide solution if 28.7 mL of this solution reacts exactly with 22.30 mL of 0.253 *M* sulfuric acid?

A) 0.197 *M*
B) 0.786 *M*
C) 7.26 *M*
D) 0.393 *M*
E) 0.221 *M*

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

5.64×10^{-3} mol

$5.64 \times 10^{-3}\ \text{mol}\ H_2SO_4 \left| \frac{2\ \text{mol NaOH}}{1\ \text{mol}\ H_2SO_4} \right. = \frac{1.13 \times 10^{-2}\ \text{mol}}{0.0287\ \text{L}} = \boxed{0.394\ M}$

9) The pH at the equivalence point of the titration of a strong acid with a strong base is:

A) 3.9
B) 4.5
C) 7.0
D) 8.2
E) none of these

10) The pH at the equivalence point of a titration of a weak acid with a strong base will be

A) less than 7.00
B) equal to 7.00
C) greater than 7.00
D) equal to the pK_a of the acid
E) more data needed to answer this question

11) A 50.0-mL sample of a 1.50 *M* NaOH solution is titrated with a 1.86 *M* HCl solution. What will be the final volume of solution when the NaOH has been completely neutralized by the HCl?

A) 90.3 mL
B) 40.3 mL
C) 75.3 mL
D) 190. mL
E) 94.3 mL

$M_1V_1 = M_2V_2$ (because all coefficients are 1)

$(50.0\text{mL})(1.50\text{M}) = (x)(1.86\text{M})$

$x = 40.3$ mL

$+ 50.0$

$\boxed{90.3\text{mL}}$

Go Vikings!!