

Name _____

AP Chem

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Chapter 14 HW - #1 (Due 11/11/2015)

Complete both free response questions. One will be graded. Show all work. Box and clearly label all final answers

1. Monochloroacetic acid, $\text{HC}_2\text{H}_2\text{ClO}_2$, is a skin irritant that is used in "chemical peels" intended to remove the top layer of dead skin from the face and improve complexion. The value of K_a for monochloroacetic acid is 1.35×10^{-3} .

- Calculate the pH for a 0.30 M solution of monochloroacetic acid.
- Calculate the percent dissociation 0.30 M solution of monochloroacetic acid.
- Calculate the pH for a 0.025 M solution of monochloroacetic acid.
- Calculate the percent dissociation 0.025 M solution of monochloroacetic acid.
- Even though percent dissociation increases as the concentration of a weak acid decreases, the $[\text{H}^+]$ decreases. Explain.

a. $1.35 \times 10^{-3} = \frac{x^2}{0.30}$ $x = 0.0201$ $\text{pH} = -\log 0.0201$

$\text{pH} = 1.70$

b. $\frac{0.0201}{0.30} \times 100 = 6.7\%$

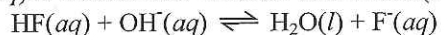
c. $1.35 \times 10^{-3} = \frac{x^2}{0.025}$ $x = 0.0058$ $\text{pH} = -\log 0.0058$

$\text{pH} = 2.24$

d. $\frac{0.0058}{0.025} \times 100 = 23.2\%$

e. Dilution shifts the reaction to the side with more particles so % dissociation increases, pH also rises as $[\text{H}^+]$ decreases when more water is added.

2. $\text{HF}(aq)$ is a weak acid. It reacts with $\text{NaOH}(aq)$ according to the reaction represented below.

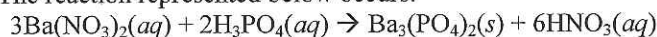


A volume of 35 mL of 0.39 M $\text{NaOH}(aq)$ is added to 45 mL of 0.40 M $\text{HF}(aq)$ solution. Assume that volumes are additive.

(a) Calculate the number of moles of $\text{HF}(aq)$ remaining in the solution.

(b) Calculate the molar concentration of $\text{F}^-(aq)$ in the solution.

In a reaction vessel, 0.900 mol of $\text{Ba}(\text{NO}_3)_2(s)$ and 0.400 mol of $\text{H}_3\text{PO}_4(aq)$ are combined with deionized water to a final volume of 2.00 L. The reaction represented below occurs.



(c) Calculate the mass of $\text{Ba}_3(\text{PO}_4)_2(s)$ formed.

(d) What is the concentration, in mol L^{-1} , of the nitrate ion, $\text{NO}_3^-(aq)$, after the reaction reaches completion?

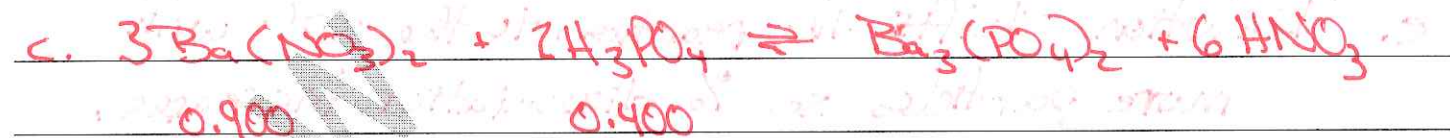
(e) What is the concentration, in mol L^{-1} , of the barium ion, $\text{Ba}^{2+}(aq)$, after the reaction reaches completion?

a. NaOH
 $0.39 \times 0.035 = x$ $x = 0.01365 \text{ moles NaOH}$

HF : $0.40 \times 0.045 = x$ $x = 0.018 \text{ moles HF}$

$0.018 \text{ moles HF} - 0.01365 = 0.00435 \text{ moles HF remain}$

b. $\text{mol F}^- = \text{moles NaOH} = \frac{0.01365 \text{ mol F}^-}{0.080} = 0.171 \text{ M F}^-$



H_3PO_4 is L.R.
 $0.400 \text{ mol H}_3\text{PO}_4 \left| \frac{1 \text{ mol Ba}_3(\text{PO}_4)_2}{2 \text{ mol H}_3\text{PO}_4} \right| \frac{601.93 \text{ g}}{1 \text{ mol Ba}_3(\text{PO}_4)_2} = 120.4 \text{ g Ba}_3(\text{PO}_4)_2$

d. $0.900 \times 2 = 1.80 \text{ mol} = 0.900 \text{ M NO}_3^-$

e. $0.400 \text{ mol H}_3\text{PO}_4 \left| \frac{3 \text{ mol Ba}^{2+}}{2 \text{ mol H}_3\text{PO}_4} \right| = 0.600 \text{ mol Ba}^{2+} \text{ needed}$
 $0.900 - 0.600 = 0.300 \div 2.0 = 0.150 \text{ M}$