Name _____ Date _____ Class _____

CHAPTER 16 REVIEW

Acid-Base Titration and pH

SECTION 16-1

SHORT ANSWER **Answer the following questions in the space provided.**

1. Calculate the following values: (A calculator should not be necessary.)

1×10^{-8} **a.** If the $[H_3O^+] = 1 \times 10^{-6}$ M for a solution, calculate the $[OH^-]$.

1×10^{-5} **b.** If the $[H_3O^+] = 1 \times 10^{-9}$ M for a solution, calculate the $[OH^-]$.

1×10^{-2} **c.** If the $[OH^-] = 1 \times 10^{-12}$ M for a solution, calculate the $[H_3O^+]$.

(.02) or 2×10^{-2} **d.** If the $[OH^-]$ in part c is reduced by half, to 0.5×10^{-12} M, calculate the $[H_3O^+]$. $= \frac{1 \times 10^{-14}}{.5 \times 10^{-12}} = .02$ or 2×10^{-2}

inversely **e.** The $[H_3O^+]$ and $[OH^-]$ are ____ (directly, inversely, or not) proportional in any system involving water.

2. Calculate the following values: (A calculator should not be necessary.)

12 **a.** If the pH = 2.0 for a solution, calculate the pOH. (14 − 2)

9.27 **b.** If the pOH = 4.73 for a solution, calculate the pH. (14 − 4.73)

3 **c.** If the $[H_3O^+] = 1 \times 10^{-3}$ M for a solution, calculate the pH.

1×10^{-5} **d.** If the pOH = 5.0 for a solution, calculate the $[OH^-]$.

1×10^{-13} **e.** If the pH = 1.0 for a solution, calculate the $[OH^-]$. $[H+] = 10^{-1}$ $[OH-] = \frac{1 \times 10^{-14}}{.1} = 1 \times 10^{-13}$

3. Calculate the following values:

4.63 **a.** If the $[H_3O^+] = 2.34 \times 10^{-5}$ M for a solution, calculate the pH.

3.2×10^{-4} **b.** If the pOH = 3.5 for a solution, calculate the $[OH^-]$.

2.2×10^{-7} **c.** If the $[H_3O^+] = 4.6 \times 10^{-8}$ M for a solution, calculate the $[OH^-]$.

~~**PROBLEMS** Write the answer on the line to the left. Show all your work in the space~~ **provided.**

4. The $[H_3O^+] = 2.3 \times 10^{-3}$ M for an aqueous solution.

4.3×10^{-12} **a.** Calculate $[OH^-]$ in this solution.

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

$[OH-] = \frac{1 \times 10^{-14}}{2.3 \times 10^{-3}} = 4.3 \times 10^{-12}$

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SECTION 16-1 continued

2.6 **b.** Calculate the pH of this solution.

$pH = -\log[H^+]$
$= -\log[2.3 \times 10^{-3}]$

11.4 **c.** Calculate the pOH of this solution.

$pOH = -\log[OH^-]$
$= -\log[4.3 \times 10^{-12}]$

d. Is the solution acidic, basic, or neutral? Explain your answer.

Acid, pH is less than 7.

5. Consider a dilute solution of 0.025 M $Ba(OH)_2$ to answer the following questions.

a. What is the $[OH^-]$ of this solution? Explain your answer.

.050 M → because there are 2 OH in solution

12.7 **b.** What is the pH of this solution?

$pOH = -\log(.050) = 1.3$
$pH = 14 - 1.3$

6. Vinegar purchased in a store may contain 6 g of CH_3COOH per 100 mL (.10L) of solution.

.999 M **a.** What is the molarity of the solute?

$6g \times \frac{1mol}{60.0516g} = .0999mol \quad M = \frac{.0999}{.10}$

b. The actual $[H_3O^+]$ of the vinegar solution in part a is 4.2×10^{-3} M. In this solution, has more than 1% or less than 1% of the acetic acid ionized? Explain your answer.

less than 1%

$\frac{4.2 \times 10^{-3} M}{.999 M} \times 100 = .42\%$

Weak **c.** Is acetic acid strong or weak, based on the ionization information from part b?

2.38 **d.** What is the pH of this vinegar solution?

$pH = -\log(4.2 \times 10^{-3})$

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1. Calculate pH and pOH for the following solutions :

a) $[H^+] = 1.0 \times 10^{-5}$ M — pH = 5, pOH = 9

b) $[OH^-] = 3.0 \times 10^{-8}$ M — pOH = 7.5, pH = 6.5

c) $[H^+] = 2.5 \times 10^{-2}$ — pH = 1.6, pOH = 12.4

d) $[OH^-] = 7.5 \times 10^{-3}$ M — pOH = 2.1, pH = 11.9

e) $[H^+] = 1.2 \times 10^{-14}$ M — pH = 13.9, pOH = .1

f) $[H^+] = 6.0$ M — pH = −.8, pOH = 13.2

2. Calculate $[H^+]$ and $[OH^-]$ for the following :

a) pH = 3.0 — $[H+] = 10^{-3} = .001$; $[OH-] = \frac{1\times10^{-14}}{.001} = 1\times10^{-11}$

b) pOH = 2.60 — $[OH-] = 10^{-2.6} = .0025$; $[H+] = \frac{1\times10^{-14}}{.0025} = 4\times10^{-12}$

c) pOH = 5.63 — $[OH-] = 10^{-5.63} = 2.3\times10^{-6}$; $[H+] = \frac{1\times10^{-14}}{2.3\times10^{-6}} = 4.3\times10^{-9}$

d) pH = 7.51 — $[H+] = 10^{-7.51} = 3.1\times10^{-8}$; $[OH-] = \frac{1\times10^{-14}}{3.1\times10^{-8}} = 3.2\times10^{-7}$

e) pOH = −1.13 — $[OH-] = 10^{+1.13} = 13.4$; $[H+] = \frac{1\times10^{-14}}{13.4} = 7.5\times10^{-15}$

f) pH = 0.03 — $[H+] = 10^{-.03} = .93$; $[OH-] = \frac{1\times10^{-14}}{.93} = 1.1\times10^{-14}$

3. Calculate the pH and the pOH of 0.050 M solutions of the following acids :

a) Perchloric acid, $HClO_4$ — Acid

$[H+] = .050M$

$pH = -\log(.050) = 1.3$

$pH = 7.3$

$pOH = 14 - 1.3$

$pOH = 12.7$

b) Carbonic acid, HNO_3 — Same

c) Potassium hydroxide, KOH

$[OH-] = .050M$

$pOH = -\log(.050)$

$pOH = 1.3$

$pH = 14 - 1.3$

$pH = 12.7$

d) Calcium hydoxide, $Ca(OH)_2$

$[OH-] = (.050) \times 2$

$[OH-] = .1$

$pOH = -\log(.1)$

$pOH = 1$

$pH = 14 - 1$

$pH = 13$