Name: KEY Date: _____ Hour: _____

AP CHEMISTRY REVIEW: ACID-BASE REACTIONS

Logarithms: Solve the following problems by re-arranging the expression on the line.

1. $10^x = 233$ $x = \log 233$ $x = 2.3674$
2. $\log x = 1.9395$ $x = 10^{1.9395}$ $x = 87$

pH Calculations: Solve the following problems. Show all your work!

3. $[H^+] = 1.0 \times 10^{-10}\ M$; pH = 10 $-\log(1.0 \times 10^{-10}) = 10$
4. $[H^+] = 3.22 \times 10^{-5}\ M$; $[OH^-]$ = $3.11 \times 10^{-10}\ M$ $\frac{10^{-14}}{3.22 \times 10^{-5}} =$
5. pH = 2.55; $[H^+]$ = $2.82 \times 10^{-3}\ M$ $10^{-2.55} = 0.00282\ M$
6. pH = 5.89; pOH = 8.11 $14 - 5.89 = 8.11$
7. pOH = 4.22; $[H^+]$ = $1.66 \times 10^{-10}\ M$ $14 - 4.22 = 9.78$ $10^{-9.78} = 1.66 \times 10^{-10}\ M$

Neutralization Reactions: Complete and *balance* the following neutralization reactions.

8. $KOH + HCl \rightarrow KCl + HOH$
9. $H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$
10. $Al(OH)_3 + 3HNO_3 \rightarrow Al(NO_3)_3 + 3\ HOH$
11. $2NaOH + H_2CO_3 \rightarrow Na_2CO_3 + 2HOH$

Acid-Base Reactions: In each of the reactions below, identify the acid, base, conjugate acid, and conjugate base by labeling below each compound.

12. $HPO_3^{-2} + H_2O \rightarrow H_2PO_3^{-1} + OH^{-1}$
    Base Acid Conj. Acid Conj. Base
13. $H_2O + H_2CO_3 \rightarrow HCO_3^{-1} + H_3O^{+1}$
    Base Acid Conj. Base Conj. Acid
14. $HNO_3 + NH_3 \rightarrow NH_4^{+1} + NO_3^{-1}$
    Acid Base Conj. Acid Conj. Base

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Titration Problems: Solve the following problems. Show all your work.

15. 10 mL of 1*M* HCl are titrated with 0.25*M* NaOH. How many milliliters of NaOH are needed to titrate the acid?

* Base is 4x weaker concentration (1M → 0.25 M)
So 4x MORE volume will be needed. **40mL**

16. Megan titrates 15 mL of HCl with 8 mL of a solution of 0.125*M* NaOH. What is the molar concentration of the HCl solution?

$NaOH + HCl \rightarrow NaCl + HOH$

$0.125M\ NaOH = \frac{x}{0.008\ L}$ $x = 0.001$ moles NaOH

$[HCl] = \frac{0.001\ mol}{0.015\ L} = \boxed{0.067M}$

17. Jacob performs a titration on a 10 mL sample of H_2SO_4. If he adds 23.3 mL of a 0.50*M* NaOH solution, what is the molar concentration of the H_2SO_4?

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

$0.50M\ NaOH = \frac{x}{0.0233L}$ $x = 0.0117$ moles NaOH $\times \frac{1\ mol\ H_2SO_4}{2\ mol\ NaOH} = 0.00583mol$

$[H_2SO_4] = \frac{0.00583mol}{0.010\ L} = \boxed{0.583M}$

18. A buret is filled with a solution of 1.0*M* KOH and used to titrate a 15 mL sample of H_3PO_4. The initial reading is 11.0 mL and the final reading is 33.8 mL at the endpoint of the titration. What is the concentration of hydrogen ions in the acid solution? What is the molarity of the phosphoric acid?

$3\ KOH + H_3PO_4 \rightarrow K_3PO_4 + 3\ HOH$

$V = 33.8mL - 11.0mL = 22.8mL\ KOH$

$1.0M\ KOH = \frac{x}{0.0228\ L}$ $x = 0.0228\ mol \times \frac{1\ H_3PO_4}{3\ KOH} = 0.0076mol\ H_3PO_4$

$[H^+] = \frac{0.0228\ mol}{0.015\ L} = \boxed{1.52M}$ $[H_3PO_4] = \frac{0.0076\ mol}{0.015\ L} = \boxed{0.51M}$