UNIT 9: Acids & Bases STUDY GUIDE
REGENTS CHEMISTRY

Name_____
Unit 9 Exam will be on Friday 4/7

Vocabulary- Match the terms to the correct definitions.

D "alternate" base
G hydroxide
L ion
O Table K
F hydronium
H molarity
I concentration
B Arrhenius base
P Table L
C "alternate" acid
E neutral
M pH
A Arrhenius acid
J electrolyte
Q Table M
K atom
N indicators

A. Compound that releases (yields) H^+ when dissolved in water.
B. Compound that releases (yields) OH^- when dissolved in water
C. An H+ donor
D. An H+ acceptor
E. Solution where $[H^+] = [OH^-]$
F. H_3O^+ ion (H^+ in H_2O)
G. OH- ion
H. Moles of solute per liter of solution (an expression of concentration)
I. "Strength" of a solution
J. Compound capable of conducting electricity when dissolved or melted
K. Neutral form of an element
L. Charged form of an element (has lost or gained electrons)
M. Scale used to measure relative concentration of H+ ions
N. Compounds that can change color depending on the pH of their environment
O. Where you can find a list of acids
P. Where you can find a list of bases
Q. Where you can find a list of indicators

Learning Target Checklist – How prepared are you for the Unit 9 test? Check yourself against this unit's learning targets.

I can identify and define acids and bases according to the Arrhenius theory.

1.) A sample of $Ca(OH)_2$ is considered to be an Arrhenius base because it dissolves in water to yield
(1) Ca^{2+} ions as the only positive ions in solution (3) OH^- ions as the only negative ions in solution
(2) H_3O^+ ions as the only positive ions in solution (4) H^- ions as the only negative ions in solution

2.) An Arrhenius acid has
(1) only hydroxide ions in solution (3) hydrogen ions as the only positive ions in solution
(2) only hydrogen ions in solution (4) hydrogen ions as the only negative ions in solution

3.) Which substance is an Arrhenius base?
(1) CH_3OH (3) LiOH
(2) CH_3Cl (4) LiCl

4.) The only positive ion found in $H_2SO_4(aq)$ is the
(1) ammonium ion (3) hydroxide ion
(2) hydronium ion (4) sulfate ion

5.) Which compound is an Arrhenius acid?
(1) CaO (3) K_2O
(2) HCl (4) NH_3

6.) Potassium hydroxide is classified as an Arrhenius base because KOH contains
(1) OH^- ions (3) K^+ ions
(2) O^{2-} ions (4) H^+ ions

7.) Which compound when dissolved in water is an Arrhenius acid?
(1) CH_3OH (3) NaCl
(2) HCl (4) NaOH

8.) When one compound dissolves in water, the only positive ion produced in the solution is H_3O^+ (aq). This compound is classified as
(1) a salt (3) an Arrhenius acid
(2) a hydrocarbon (4) an Arrhenius base

9.) When dissolved in water, an Arrhenius base yields
(1) hydrogen ions (3) hydroxide ions
(2) hydronium ions (4) oxide ions

10.) Which substance yields H^+ (aq) as the only positive ion in an aqueous solution? – acid (Table K)
(1) CH_3CHO (3) CH_3COOH
(2) CH_3CH_2OH (4) CH_3OCH_3

11.) A substance that dissolves in water and produces hydronium ions as the only positive ions in the solution is classified as
(1) an alcohol (3) a base
(2) an acid (4) a salt

I can state the relationship between hydronium (hydrogen) ion concentration and pH scale. I know where acids and bases are along the pH scale.

pH ↓ H^+ ↑

1.) When the pH of a solution changes from a pH of 5 to a pH of 3, the hydronium ion concentration is
(1) 0.01 of the original content
(2) 0.1 of the original content
(3) 10 times the original content
(4) 100 times the original content

2.) Which of these 1 M solutions will have the highest pH?
(1) NaOH
(2) CH_3OH
(3) HCl
(4) NaCl

basic

3.) Given the following solutions:
Solution *A*: pH of 10 ← lowest H^+
Solution *B*: pH of 7
Solution *C*: pH of 5 ← highest H^+
Which list has the solutions placed in order of increasing H^+ concentration?
(1) *A, B, C*
(2) *B, A, C*
(3) *C, A, B*
(4) *C, B, A*

4.) A solution with a pH of 2.0 has a hydronium ion concentration ten times greater than a solution with a pH of
(1) 1.0
(2) 0.20
(3) 3.0
(4) 20.

pH ↓ H^+ ↑

5.) When the pH value of a solution is changed from 2 to 1, the concentration of hydronium ions
(1) decreases by a factor of 2
(2) increases by a factor of 2
(3) decreases by a factor of 10
(4) increases by a factor of 10

6.) When the pH of a solution is changed from 4 to 3, the hydronium ion concentration of the solution
(1) decreases by a factor of 10
(2) increases by a factor of 10
(3) decreases by a factor of 100
(4) increases by a factor of 100

7.) When the hydronium ion concentration of a solution is increased by a factor of 10, the pH value of the solution
(1) decreases 1 pH unit
(2) decreases 10 pH units
(3) increases 1 pH unit
(4) increases 10 pH units

I can use Table M to determine what color an indicator will be in a given solution, based on its pH.

Base your answers to questions 1 through 2 on the information below.

The active ingredient in the pain reliever aspirin is acetylsalicylic acid. This compound can be produced by reacting salicylic acid with acetic acid. The label of one aspirin bottle indicates that the accepted mass of acetylsalicylic acid in each tablet is 325 milligrams. In a laboratory, an aspirin tablet is crushed and mixed with water to dissolve all of the acetylsalicylic acid. The measured pH of the resulting solution is 3.0.

1.) Write the chemical formula for the acetic acid.

CH_3COOH or $HC_2H_3O_2$

2.) State the color of methyl orange indicator after the indicator is placed in the solution.

Red

Base your answer to question 3 on the information below.

Vitamin C, also known as ascorbic acid, is water soluble and cannot be produced by the human body. Each day, a person's diet should include a source of vitamin C, such as orange juice. Ascorbic acid has a molecular formula of $C_6H_8O_6$ and a gram-formula mass of 176 grams per mole.

3.) What is the color of the indicator thymol blue after it is added to an aqueous solution of vitamin C?

yellow

I can write simple neutralization reactions when given the reactants or products.

Directions: Write the products and balance the equation for each of the following reactions.

Example: **2** HBr + **1** $Mg(OH)_2$ → **1** $MgBr_2$ + **2** H_2O

1. 1 HNO_3 + 1 KOH → 1 H_2O + 1 KNO_3

2. 1 H_2SO_4 + 2 $NaOH$ → 2 H_2O + 1 Na_2SO_4

3. 1 HCl + 1 $LiOH$ → 1 H_2O + 1 $LiCl$

4. 1 H_2SO_4 + 2 KOH → 2 H_2O + 1 K_2SO_4

5. 2 HI + ___ $Ca(OH)_2$ → 2 H_2O + CaI_2

I can use the titration equation to determine an unknown molarity or volume of an acid or base.

Base your answers to questions 1 through 2 on the information below.

In a titration, a few drops of an indicator are added to a flask containing 35.0 milliliters of $HNO_3(aq)$ of unknown concentration. After 30.0 milliliters of 0.15 M NaOH(aq) solution is slowly added to the flask, the indicator changes color, showing the acid is neutralized.

1.) Complete the equation *below* for this neutralization reaction by writing the formula of *each* product.

$$HNO_3(aq) + NaOH(aq) \rightarrow \underline{\quad H_2O \quad} + \underline{\quad NaNO_3 \quad}$$

2.) In the space *below,* show a numerical setup for calculating the concentration of the $HNO_3(aq)$ solution.

$M_A V_A = M_B V_B$

$x(35) = (0.15)(30)$

3.) How many mL of 2.0 M NaOH are required to exactly neutralize 100. mL of 3.0 M solution of HBr?

$(3.0)(100) = x\,(2.0)$

$x = 150\,mL$

4.) How many mL of 2.0 M HBr are needed to exactly neutralize 20. mL of 4.0 M KOH?

$(2.0)\,x = (4.0)(20)$

$x = 40\,mL$

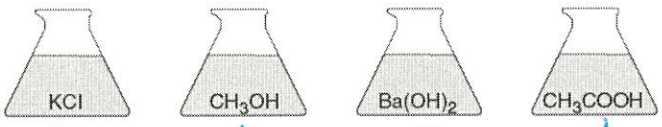
5.) If 50.0 milliliters of 3.0 M HNO_3 completely neutralized 150.0 mL of KOH, what was the molarity of the KOH solution?

$(3.0)(50) = x\,(150)$

$x = 1.0\,M$

I can classify electrolytes as acids, bases, or salts.

6. Four flasks each contain 100 milliliters of aqueous solutions of equal concentrations at 25°C and 1 atm.



a b c d

a. Which solutions contain electrolytes?

a, c, d

b. Which solution has the lowest pH?

d (acid)

c. What causes some aqueous solutions to have a low pH?

presence of H^+ ions

d. Which solution is most likely to react with an Arrhenius acid to form a salt and water?

c (base)