Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Notes:**

**Acids and Bases**

****

**Acid:**

**Example:**

**Properties of an acid:**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Base:**

**Example:**

**Properties of a base:**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Neutralization:**

**Example of a neutralization:**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**pH Scale:**

**The ratio of [H+] to [OH-] determines pH**

**In acids [H+] > [OH-]**

**In bases [H+] < [OH-]**

**When neutral [H+] = [OH-]**

**Practice Problems**

1. Use Table K and Table L to help you identify the rules for determining whether a substance is an acid, a base, or a salt based on the formula. Underline all the acids, circle bases, and box in organic compounds.

 NH3 NaCl CH3OH H2SO4 Ca(OH)2 CH4

 NH4Br HCl Na2SO4 HNO3 CH3COOH NaOH

 H3PO4 LiOH CH2(OH)2 NH4OH Ca(NO3)2 HC2H3O2

* All acids have the \_\_\_\_\_\_\_\_\_\_\_\_ ion in common.
* All bases have the \_\_\_\_\_\_\_\_\_\_\_\_\_ ion in common.
* All salts have formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* All other compounds have formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Organic acids have the general formula: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Which formula represents a hydrogen ion?

(1) H+ (2) OH– (3) NH4+ (4) HCO3–

3. Which compound is an acid?

(1) H2SO4 (2) NaOH (3) KCl (4) NH3

4. Which substance is an acid?

(1) Ba(OH)2 (2) H3PO4 (3) CH3COOCH3 (4) NaCl

5. Which compound releases hydroxide ions in an aqueous solution?

(1) CH3COOH (2) HCl (3) CH3OH (4) KOH

6. Which two compounds are electrolytes?

 (1) C6H12O6 and CH3CH2OH

 (2) C6H12O6 and HCl

 (3) NaOH and HCl

 (4) NaOH and CH3CHOH

7. When one compound dissolves in water, the only positive ion produced in the solution is H+(aq). This compound is classified as

 (1) a salt (2) a hydrocarbon

 (3) an Arrhenius acid (4) an Arrhenius base

8. An aqueous solution of lithium hydroxide contains hydroxide ions as the only negative ion in solution. Lithium hydroxide is classified as an

 (1) aldehyde (3) Arrhenius acid

 (2) alcohol (4) Arrhenius base

9. Which compound is an acid?

 (1) H2SO4  (3) NaOH

 (2) KCl (4) NH3

10. A base yields which ion as the only negative ion in an aqueous solution?

 (1) hydride ion (3) hydronium ion

 (2) hydrogen ion (4) hydroxide ion

**Strong or Weak, Concentrated or Dilute?**

Directions: For each case, decide if the picture shows a weak or strong, and concentrated or dilute solution.

Acid: H+ ion: Anion A-:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **W/S and C/D** | **Example** |
| Case 1 |   |  |  |
| Case 2 |  |  |  |
| Case 3 |   |  |  |
| Case 4 |   |  |  |

5. What does concentrated mean in terms of amount of particles? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6. What does dilute mean in terms of amount of particles?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

7. What does strong mean in terms of ions? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. What does weak mean in terms of ions? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The pH Scale**

**The pH scale is a measure of the H+ or H3O+ concentration in a solution. “pH” stands for “potential to ATTRACT Hydrogen ions” “potential to ATTRACT Hydrogen ions**

* **Acids have a LOW pH (a LOW potential to attract H+ ions (release/DONATE H+)**
* **Bases have a HIGH pH (a HIGH potential to attract H+ ions (bases are H+ acceptors)**

**The pH scale is logarithmic, which means that a change of *one* pH unit will change the concentration of H+ by a factor of 10.**



1. What is the relationship between pH value and hydrogen ion concentration?

2. Which substance is 10000 times more acidic than seawater?

3. What substance is 100 times more basic than lemon juice?

4. Complete the table below using the grid above:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Hydronium Ion Concentration (M)** | **pH** | **Acid or Base?** |
| Stomach fluids |  |  |  |
| Lemon Juice |  |  |  |
| Tomato Juice |  |  |  |
| Milk |  |  |  |
| Blood |  |  |  |
| Seawater |  |  |  |
| Milk of Magnesia |  |  |  |
| Aqueous Ammonia |  |  |  |
| Bleach |  |  |  |

5. Using the table you created, complete the rules for pH of acids and bases:

1. Acids have pH values in the range of \_\_\_ to \_\_\_ and hydronium ion concentrations between \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
2. Bases have pH values in the range of \_\_\_ to \_\_\_ and hydronium ion concentrations between \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. To obtain the pH of an acid or base, find the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the hydronium concentration. Therefore, pH can also be known as the “power” of the hydronium concentration.

6. Find the pH of the following solutions and determine if its acidic or basic:

|  |  |  |
| --- | --- | --- |
| **Acid Concentration** | **pH** | **Acid or Base? (or neutral ☺)** |
| [H3O+] = 1x10-2 |  |  |
| [H3O+] = 1x10-7 |  |  |
| [H3O+] = 1x10-10 |  |  |
| [H+] = 1x10-11 |  |  |
| [H+] = 1x10-5 |  |  |
| [H3O+] = 0.0010 |  |  |
| [H3O+] = 0.0000010 |  |  |
| [H+] = 0.0000000010 |  |  |

7. Circle one to complete the table:

|  |  |  |
| --- | --- | --- |
|  | **If an ACID is added…** | **If a BASE is added…** |
| **pH** | Increases or Decreases | Increases or Decreases |
| **[H+] or [H3O+]** | Increases or Decreases | Increases or Decreases |
| **[OH–]** | Increases or Decreases | Increases or Decreases |
| **Solution becomes more** | Acidic or Basic | Acidic or Basic |

**Indicators**

**How to use Table M:**

* If the pH is below the first number, the solution will be the first color listed
* If the pH is above the second number, the solution will be the second color listed
* If the pH is between the numbers, the solution will be a mix of the two colors

 Table M

Ex: If you add bromthymol blue… to a solution with a pH of 8, it will be blue

 to a solution with a pH of 6, it will be green

 to a solution with a pH of 4, it will be yellow

Color in the table below using Table M:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Methyl Orange |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Bromothymol Blue |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Phenolphthalein |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Litmus |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Bromcresol Green |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Thymol Blue |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

1. Which indicator would best distinguish between a solution with a pH of 3.5 and another with a pH of 5.5?

(1) bromthymol blue (3) litmus

(2) bromcresol green (4) thymol blue

2. In which solution will bromcresol green appear blue?

(1) 1 M NaCl (3) 1 M NH3

(2) 1 M H2CO3 (4) 1 M CH3COOH

3. In which solution will thymol blue indicator appear blue?

(1) 0.1 M CH3COOH (3) 0.1 M KOH

(2) 0.1 M HCl (4) 0.1 M H2SO4

4. What is the color of the indicator methyl orange in a solution that has a pH of 2?

(1) blue (3) yellow

(2) orange (4) red

5. In a solution with a pH of 3, what color is bromcresol green?

(1) yellow (3) green

(2) blue (4) red