Name: _____ Off. Class: _____ Per: _____ Date: _____

Teacher: _____ Acid/Base Short Response Practice Chemistry

Base your answers to questions **1** and **2** on the information below and on your knowledge of chemistry.

Vinegar is a commercial form of acetic acid, $HC_2H_3O_2(aq)$. One sample vinegar has a pH value of 2.4.

1. Explain, in terms of particles, why $HC_2H_3O_2(aq)$ can conduct an electric current.

2. State the color of bromthymol blue indicator in a sample of the commercial vinegar.

Base your answers to questions **3** and **4** on the information below.

In a titration, 20.0 milliliters of 0.15 M HCl(aq) is exactly neutralized by 18.0 milliliters of KOH(aq).

3. Compare the number of moles of $H^+(aq)$ ions to the number of moles of $OH^-(aq)$ ions in the titration mixture when the HCl(aq) is exactly neutralized by the KOH(aq).

4. Complete the equation below for the neutralization reaction by writing the formula of *each* product.

$KOH(aq) + HCl(aq) \rightarrow$ _____ + _____

Base your answers to questions **5** through **7** on the information below.

Some carbonated beverages are made by forcing carbon dioxide gas into a beverage solution. When a bottle of one kind of carbonated beverage is first opened, the beverage has a pH value of 3.

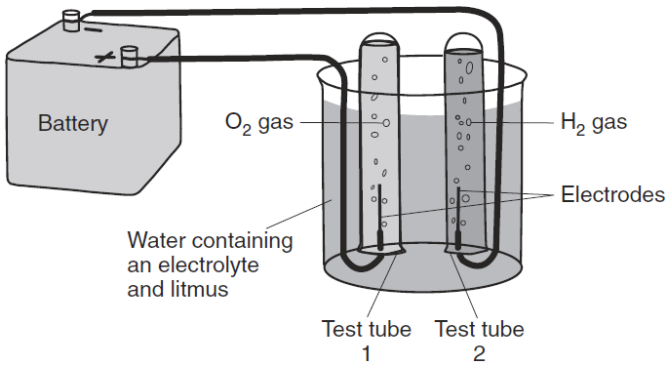
5. After the beverage bottle is left open for several hours, the hydronium ion concentration in the beverage solution decreases to $\frac{1}{1000}$ of the original concentration. Determine the new pH of the beverage solution.

6. Using Table *M*, identify *one* indicator that is yellow in a solution that has the same pH value as this beverage.

7. State, in terms of the pH scale, why this beverage is classified as acidic.

8. Base your answer to the following question on the information below.

The diagram below shows a system in which water is being decomposed into oxygen gas and hydrogen gas. Litmus is used as an indicator in the water. The litmus turns red in test tube 1 and blue in test tube 2.



The oxidation and reduction occurring in the test tubes are represented by the balanced equations below.

Test tube 1: $2H_2O(\ell) \rightarrow O_2(g) + 4H^+(aq) + 4e^-$

Test tube 2: $4H_2O(\ell) + 4e^- \rightarrow 2H_2(g) + 4OH^-(aq)$

Explain, in terms of the products formed in test tube 2, why litmus turns blue in test tube 2.

Base your answers to questions **9** through **11** on the information below.

A student used blue litmus paper and phenolphthalein paper as indicators to test the pH of distilled water and five aqueous household solutions. Then the student used a pH meter to measure the pH of the distilled water and each solution. The results of the student's work are recorded in the table below.

Testing Results

Liquid Tested	Color of Blue Litmus Paper	Color of Phenolphthalein Paper	Measured pH Value Using a pH Meter
2% milk	blue	colorless	6.4
distilled water	blue	colorless	7.0
household ammonia	blue	pink	11.5
lemon juice	red	colorless	2.3
tomato juice	red	colorless	4.3
vinegar	red	colorless	3.3

9. Based on the measured pH values, identify the liquid tested that is 10 times more acidic than vinegar.

10. Explain, using the reference table, in terms of the pH range for color change why litmus is *not* appropriate to differentiate the acidity levels of tomato juice and vinegar.

11. Identify the liquid tested that has the *lowest* hydronium ion concentration.

Base your answers to questions **12** through **14** on the information below.

Soil pH can affect the development of plants. For example, a hydrangea plant produces blue flowers when grown in acidic soil but pink flowers when grown in basic soil. Evergreen plants can show a yellowing of foliage, called chlorosis, when grown in soil that is too basic.

Acidic soil can be neutralized by treating it with calcium hydroxide, $Ca(OH)_2$, commonly called slaked lime. Slaked lime is slightly soluble in water.

12. Write an equation, using symbols *or* words, for the neutralization of the ions in acidic soil by the ions released by slaked lime in water.

13. An evergreen plant has yellowing foliage. The soil surrounding the plant is tested with methyl orange and bromthymol blue. Both indicators turn yellow in the soil tests. State, in terms of pH value, why the yellowing of the plant is *not* due to chlorosis.

14. Compare the hydrogen ion concentration to the hydroxide ion concentration in soil when a hydrangea plant produces pink flowers.

Answer Key
Acid Base Short Answer

1. — The $HC_2H_3O_2$ (aq) has ions in water, which are mobile. — The charged particles move freely. — Acetic acid forms movable ions in aqueous solutions
2. — Yellow
3. — The number of moles of H^+(aq) ions equals the number of moles of OH^-(aq) ions. — The number of hydrogen ions is the same as the number of hydroxide ions.
4. —$H_2O(\ell)$ and KCl(aq) —KCl and HOH
5. – 6
6. – bromthymol blue – bromcresol green – thymol blue
7. – The beverage is acidic because its pH value is below 7. – A pH of 3 is in the acid range on the pH scale.
8. • Litmus turns blue when a sufficient amount of hydroxide ions are produced. • The reaction in test tube 2 produces OH^- ions that make this solution basic. Litmus is blue in a basic solution.
9. Answer: lemon juice
10. Examples: Because litmus changes color in a pH range of 5.5 to 8.2, litmus cannot be used to differentiate between a pH of 3.3 and 4.3; Litmus is red for all pH values below 5.5.
11. Examples: household ammonia; NH_3(aq)
12. *Examples:* H_3O^+(aq) + OH^-(aq) $\rightarrow$ $2H_2O(\ell)$; $H^+ + OH^- \rightarrow$ HOH hydrogen ions + hydroxide ions $\rightarrow$ water; hydroxide ions + hydronium ions $\rightarrow$ water
13. *Examples:* – The pH is between 4.4 and 6.0, which indicates an acidic soil. – The pH of the soil surrounding the plant is below 6.0. – For chlorosis, the soil pH must be above 7.
14. *Examples:* – The hydroxide ion concentration is greater than the hydrogen ion concentration. – The H_3O^+ concentration is less than the OH^- concentration. [OH^-] > [H_3O^+]