Name: \_\_\_\_\_\_KEY\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ REVIEW for Acid-Base Test

1. \_\_\_\_\_\_ Solution *A* has a pH of 3 and solution *Z* has a pH of 6. How many times greater is the hydronium ion concentration in solution *A* than the hydronium ion concentration in solution *Z*?

(a) 100 (b) 2 (c) 3 (d) 1000

2. \_\_\_\_\_\_\_ An Arrhenius base yields which ion as the only negative ion in an aqueous solution?

(a) hydride ion (b) hydroxide ion

(c) hydronium ion (d) hydrogen ion

3. \_\_\_\_\_\_\_ Which reactants form the salt CaSO4(s) in a neutralization reaction?

(a) H2S(g) and Ca(ClO4)2(s)

(b) H2SO3(aq) and Ca(NO3)2(aq)

(c) H2SO4(aq) and Ca(OH)2(aq)

(d) SO2(g) and CaO(s)

4. \_\_\_\_\_\_\_ A student tested a 0.1 M aqueous solution and made the following observations:

• conducts electricity

• turns blue litmus to red

• reacts with Zn(s) to produce gas bubbles

Which compound could be the solute in this solution?

(a) CH3OH (b) LiBr (c) HBr (d) LiOH

5. \_\_\_\_\_\_\_ What volume of 0.500 M HNO3(aq) must completely react to neutralize 100.0 milliliters of 0.100 M KOH(aq)?

(a) 10.0 mL (b) 20.0 mL (c) 50.0 mL (d) 500. mL

6. \_\_\_\_\_\_\_ Which compound is an Arrhenius acid?

(a) HC2H3O2 (b) NaOH (c) KCl (d) NH3

7. \_\_\_\_\_\_\_ One acid-base theory states that an acid is

(a) an H– donor (b) an H+ donor

(c) an H– acceptor (d) an H+ acceptor

8. \_\_\_\_\_\_\_ Which of these pH numbers indicates the strongest acid?
(a) 1 (b) 3 (c) 8 (d) 12

9. \_\_\_\_\_\_\_What color is methyl orange in a solution that has a pH of 5?
(a) red (b) orange (c) blue (d) yellow

10. \_\_\_\_\_\_\_Which pH change represents a hundredfold increase in the concentration of H30+?
(a) pH 3 to pH 2 (b) pH 7 to pH 9

(c) pH 5 to pH 3 (d) pH 13 to pH 14

11. \_\_\_\_\_\_\_ The pH of a pond water is 9.0, after a spill of acid the pond is 1000 more acidic. What is the new pH of the pond?
(a) 12 (b) 6 (c) 7 (d) 5

12. \_\_\_\_\_\_\_ As pH decreases

(a) [H+] increases only (b) [H+] decreases only (c) [OH-] increases only (d) [H+] increases and [OH-] decreases

13. \_\_\_\_\_ Which substance acts as an acid in the reverse reaction?

 HI(g) + H2O(l) <--> H3O+(aq) + I-(aq)
(a) H20 (b) I- (c) H3O+ (d) HI

14. \_\_\_Given the reaction below, HNO2 + F- <--> HF + NO2 in the reverse reaction, HF is a/an
(a) acid by accepting H+ (b) base by accepting H+ (c) base by donating H+ (d) acid by donating H+

15. \_\_\_\_\_ In MaVa=MbVb, what is Mb?
(a) molarity of OH- (b) molarity of H+ (c) molarity of H- (d) molarity of O2

16. \_\_\_\_\_ What is the molarity of HCl(aq) if 25. milliliters of 8.0M NaOH(aq) neutralizes exactly 20. milliliters of HCl(aq)?
(a) 5M (b) 10M (c) 15M (d) 20M

17. \_\_\_\_\_ When NaOH and HCl react, what will be on the product side?
(a) only NaCl (b) only HOH (c) NaCl and HOH (d) NaCl and Cl2

18. \_\_\_\_\_ At a pH of 7

(a) [H+] is greater that [OH-] (b) [OH-] is greater that [H+] (c) [H+] is equal to [OH-]

19. \_\_\_\_\_ In the process of neutralization, an Arrhenius acid and an Arrhenius base react to form which of the following?
(a) Water only (b) Salt and Carbon dioxide (c) Water and Carbon dioxide (d) Water and Salt

20. \_\_\_\_\_ Which of the following can conduct an electric current?
(a) Mg(OH)2(s) (b) H2O(s) (c) NaOH(aq) (d) NH4Cl(s)

Base your answers to questions 21 and 22 on the information below.

Using burettes, a student titrated a sodium hydroxide solution of unknown concentration with a standard solution of 0.10 M hydrochloric acid. The data are recorded in the table below.

**Titration Data**

|  |  |  |
| --- | --- | --- |
| **Solution** | **HCl (aq)** | **NaOH (aq)** |
| **Initial Burette Reading** (mL) | **15.50** | **5.00** |
| **Final Burette Reading** (mL) | **25.00** | **8.80** |

21. Determine *both* the total volume of HCl(aq) and the total volume of NaOH(aq) used in the titration. [1]

HCl 25.00-15.50 = 9.5 mL

NaOH 8.80-5.00 = 3.8mL

22. Calculate the molarity of the sodium hydroxide solution. Show all work. [1]

0.10 M(9.5mL) = Mb (3.8mL)

Mb = 0.25M NaOH

Base your answers to questions 23 and 24 on the information below.

Three bottles of liquids labeled 1, 2, and 3 were found in a storeroom. One of the liquids is known to be drain cleaner. Drain cleaners commonly contain KOH or NaOH. The pH of each liquid at 25°C was determined with a pH meter. The table below shows the test results.

**pH Test Results**

|  |  |
| --- | --- |
| **Bottle** | **pH of liquid** |
| **1** | **3.8** |
| **2** | **7.0** |
| **3** | **12.8** |

23. Explain how the pH results in this table enable a student to correctly conclude that bottle 3 contains the drain cleaner. [1]

Drain cleaner contains KOH or NaOH, which are bases with a pH value greater than 7.

A pH of 12.8 indicates a base.

A base has a pH above 7.

24. Explain, in terms of the pH values, why thymol blue is *not* a suitable indicator to distinguish between the contents of bottle 1 and bottle 2. [1]

The liquids in bottle 1 and bottle 2 both have a pH below 8, but thymol blue does not change color until the pH value reaches at least 8.0.

The pH range for the thymol blue color change is too high.

Base your answers to questions 25 and 26 on the passage below.

Acid rain lowers the pH in ponds and lakes and over time can cause the death of some aquatic life. Acid rain is caused in large part by the burning of fossil fuels in power plants and by gasoline-powered vehicles. The acids commonly associated with acid rain are sulfurous acid, sulfuric acid, and nitric acid. In general, fish can tolerate a pH range between 5 and 9. However, even small changes in pH can significantly affect the solubility and toxicity of common pollutants. Increased concentrations of these pollutants can adversely affect the behavior and normal life processes of fish and cause deformity, lower egg production, and less egg hatching.

25. Acid rain caused the pH of a body of water to decrease. Explain this pH decrease in terms of the change in concentration of hydronium ions. [1]

The pH goes down because there are more hydronium ions in solution.

[H3O+]

26. Write the chemical formula of a *negative* polyatomic ion present in an aqueous nitric acid solution. [1]

NO3– or NO31– or NO3–1 or OH–.