Chem 1 Test Chapter 19 **Version Ⓑ** Name: Answer Key
Acids & Bases Date: _____
Dr. Casagrande / Mrs. Rinaldi _____ / 75 pts Period: ____

Multiple Choice

[2 pts each] *Identify the letter of the choice that best completes the statement or answers the question.*

A 1. Acids taste …
A. sour. B. salty. C. sweet. D. bitter.

A 2. When acids react with metals such as Mg, what gas is formed?
A. H_2 (g) B. He (g) C. H_2O (g) D. O_2 (g)

C 3. Aqueous solutions of bases are corrosive to …
A. skin tissue and most metals. B. neither skin tissue nor metals.
C. skin tissue only (and one special metal). D. metals only.

B 4. In basic solutions, phenolphthalein turns …
A. yellow. B. pink. C. green. D. blue.

A 5. Aqueous solutions of acids or bases …
A. conduct electricity. B. cannot be prepared.
C. have magnetic properties. D. have very low boiling points.

A 6. According to the Arrhenius definition, an acid …
A. ionizes to form H^+ ions in H_2O. B. ionizes to form O^{2-} ions in H_2O.
C. does not ionize. D. ionizes to form OH^- ions in H_2O.

D 7. In the Brønsted-Lowry model, conjugate bases are formed when…
A. an acid gains OH^-. B. an acid loses OH^-.
C. an acid gains H^+. D. an acid loses H^+.

C 8. Compounds that can act as either an acid or a base, such as H_2O or HSO_4^-, are called …
A. amphibious. B. ambitious.
C. amphoteric. D. ambidextrous.

A 9. According to the Brønsted-Lowry model of acids, as the strength of the attraction of the bond holding the H *increases*, what happens to the acid?
A. Acid strength decreases. B. The acid explodes.
C. Acid strength increases. D. The acid solidifies.

B 10. A strong acid or base is one that…
A. ionizes 50%. B. ionizes completely.
C. ionizes very little. D. does not ionize.

C 11. Acetic acid ($HC_2H_3O_2$) has an acid dissociation constant, $K_a = 1.8\times10^{-5}$ and propionic acid ($HC_3H_5O_2$) has an acid dissociation constant, $K_a = 1.3\times10^{-5}$. Which of the following is true?
A. Both acids are considered strong electrolytes.
B. Both acids have the same strength.
C. Acetic acid is a stronger electrolyte than propionic acid.
D. Propionic acid is a stronger electrolyte than acetic acid.

B 12. In any aqueous solution, the product of $[H^+]$ and $[OH^-]$ …

A. equals 14.
B. equals 1.0×10^{-14}.
C. cannot be determined.
D. equals 7.

A 13. An aqueous solution whose pH is 10…

A. is basic.
B. might be neutral, basic, or acidic.
C. is neutral.
D. is acidic.

C 14. What kind of reaction is involved in titration of an acid and a base?

A. completion.
B. dissemination.
C. neutralization.
D. evolution.

A 15. What are the products formed in the type reaction indicated in the previous question?

A. A salt and water.
B. H_2 gas
C. An acid and water.
D. A base and water.

A 16. An acid-base titration is carried out by monitoring changes in…

A. pH.
B. density.
C. temperature.
D. pressure.

D 17. During the titration of a *weak acid* with a *strong base*, the pH at the equivalence point will be…

A. < 7
B. $= 0$
C. $= 7$
D. > 7

C 18. In a titration, the pH at which the moles of H^+ added is equal to the moles of OH^- is the …

A. endpoint.
B. pH interval.
C. equivalence point.
D. transition interval.

D 19. The *endpoint* of a titration is determined by …

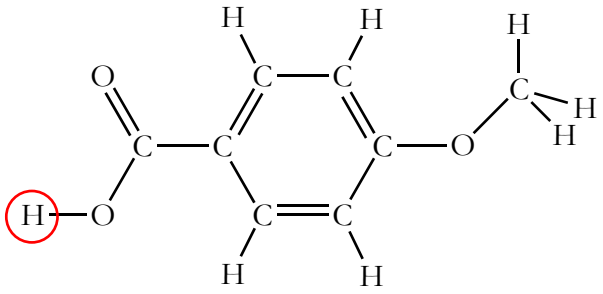
A. the point at which the solution being titrated begins to boil.
B. evolution of CO_2 gas from the reaction mixture.
C. the point at which no titrant is left in the buret.
D. the pH at which the indicator changes color.

B 20. In the article, *An Invisible Fire*, why is hydrofluoric acid (HF) so dangerous?

A. It causes severe chemical burns.
B. The F^- ions bind to calcium and magnesium in the body's cells.
C. It is an extremely strong acid.
D. The H^+ ions absorb O_2 from the blood.

Short Answer

21. [2 pts] Below is the Lewis structure of 4-methoxybenzoic acid. Circle the hydrogen atom(s) that can be ionized and explain your selection. You may draw additional symbols on the structure to help.



The selected H atom is part of an O–H bond, which is very polar so capable of being ionized.

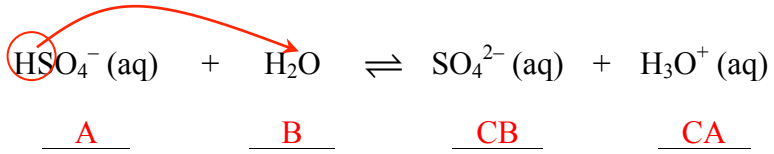
22. [2 pts] Write the conjugate base for each of the following acids. *Watch the charges.*

a) $HTeO_3^-$ TeO_3^{2-} b) $HClO_3$ ClO_3^-

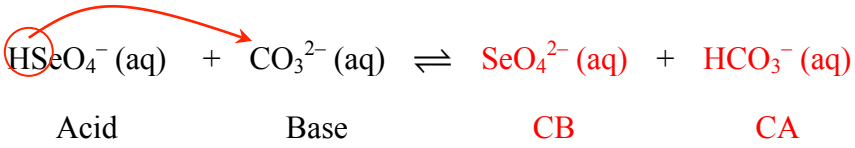
23. [2 pts] Write the conjugate acid for each of the following bases. *Watch the charges.*

a) HCO_3^- H_2CO_3 b) $C_2H_5NH_2$ $C_2H_5NH_3^+$

24. [5 pts] For following reaction, **circle the H^+ being transferred and draw an arrow** showing its transfer from the acid to the base *in the reactants* (look at the products—which way does the H^+ go?) and **label** the acid (**A**), the base (**B**), the conjugate acid (**CA**), and the conjugate base (**CB**).



25. [5 pts] For the following reaction, **circle the H^+ being transferred and draw an arrow** showing its transfer from the acid to the base *in the reactants*, then **determine the products** of the reaction and **label** the conjugate acid (**CA**) and the conjugate base (**CB**). *Watch the charges!*



26. [3 pts] If the pH of one solution is 7 and another has a pH of 3, which solution has a higher $[H^+]$? By what *factor* is this solution stronger than the other solution? Explain or use a calculation to show why.
The solution with pH = 3 has a higher $[H^+]$, $[H^+] = 10^{-pH} = 1.0\times10^{-3}$ M, while the first solution has $[H^+] = 10^{-pH} = 1.0\times10^{-7}$ M. The second solution is 10,000 times stronger (more concentrated) because each pH unit is a factor of 10 so a 4 pH unit *decrease* indicates a 10^4 *increase* in $[H^+]$: $\frac{[H^+]_2}{[H^+]_1} = \frac{1.0\times10^{-3}}{1.0\times10^{-7}} = 10^4 = 10{,}000$.

Problems

Solve the following problems using the equations on the reference packet. To get full credit, ***YOU MUST SHOW ALL YOUR WORK IN YOUR ANSWER! Use correct Sig Figs!***

27. [3 pts] Strontium hydroxide, $Sr(OH)_2$ is a strong base. Determine the pH of a 0.0230 M of $Sr(OH)_2$.

$[OH^-] = 2[Sr(OH)_2] = 0.0460$ M

$pOH = -\log[OH^-] = -\log(0.0460) = 1.34$

$pH = 14.00 - pOH = 14.00 - 1.34 = \boxed{12.66}$

OR

$[H^+] = \frac{1.0\times10^{-14}}{0.0460} = 2.17\times10^{-13}$ M

$pH = -\log(2.17\times10^{-13}) = \boxed{12.66}$

28. [4 pts] What are the $[H^+]$, pH, and pOH at 298 K of a solution with $[OH^-] = 6.2 \times 10^{-14}$ M? Is this solution **acidic, basic, or neutral**?

$$pOH = -\log[OH^-] = -\log(6.2\times10^{-14}) = \boxed{13.21}$$

$$pH = 14.00 - pOH = 14.00 - 13.21 = \boxed{0.79}$$

$$[H^+] = 10^{-pH} = 10^{-0.79} = \boxed{1.6\times10^{-1}\ \text{M}\ (0.16\ \text{M})}$$

OR

$$[H^+] = \frac{1.0\times10^{-14}}{[OH^-]} = \frac{1.0\times10^{-14}}{6.2\times10^{-14}} = \boxed{0.16\ \text{M}}$$

$$pH = -\log[H^+] = -\log(0.16) = \boxed{0.79}$$

Acidic

29. [3 pts] Write a *balanced* neutralization equation for the following acid-base reaction:
$HBrO_3$ (bromic acid) and $Ca(OH)_2$ (calcium hydroxide)

$$2\ HBrO_3\ (aq) + Ca(OH)_2\ (aq) \rightarrow 2\ H_2O\ (l) + Ca(BrO_3)_2\ (aq)$$

30. 20.0 mL of RbOH solution was neutralized by 15.53 mL of 0.283 M HF solution according to the balanced reaction,

$$HF(aq) + RbOH(aq) \rightarrow RbF(aq) + H_2O(l)$$

a. [3 pts] How many moles of RbOH were neutralized?

$$\text{mol NaOH} = 0.01553\ \text{L HF} \times \frac{0.283\ \text{mol}}{1\ \text{L}} \times \frac{1\ \text{mol RbOH}}{1\ \text{mol HF}} = \boxed{0.00439\ \text{mol RbOH}}$$

b. [2 pts] What is the concentration of the RbOH solution?

$$[\text{RbOH}] = \frac{0.00439\ \text{mol RbOH}}{0.02000\ \text{L}} = \boxed{0.220\ \text{M}}$$

[1 pt extra credit]

A 31. Why do chemistry teachers like to teach about ammonia?

A. Because it's basic material.
B. They don't—they actually hate it.
C. Because it's odor-rific!
D. Because it cleans and shines glass.