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.*

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

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

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

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

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

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

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

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

C 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 increases. B. The acid solidifies.
C. Acid strength decreases. D. The acid explodes.

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

A 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. Acetic acid is a stronger electrolyte than propionic acid.
B. Propionic acid is a stronger electrolyte than acetic acid.
C. Both acids are considered strong electrolytes.
D. Both acids have the same strength.

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

A. cannot be determined. B. equals 7.
C. equals 14. D. equals $1.0\times10^{-14}$.

C 13. An aqueous solution whose pH is 10…

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

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

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

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

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

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

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

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

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

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

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

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

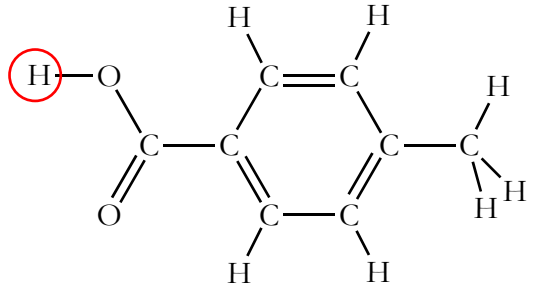
A. the point at which no titrant is left in the buret.
B. the pH at which the indicator changes color.
C. the point at which the solution being titrated begins to boil.
D. evolution of $CO_2$ gas from the reaction mixture.

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

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

**Short Answer**

21. [2 pts] Below is the Lewis structure of 4-methylbenzoic 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.

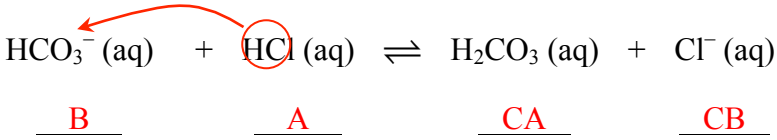
22. [2 pts] Write the conjugate base for each of the following acids. *Watch the charges.*

a) $HBrO_3$ $BrO_3^-$ b) $HSeO_3^-$ $SeO_3^{2-}$

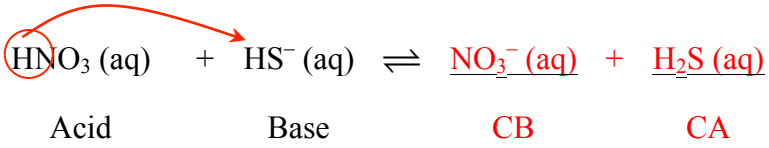
23. [2 pts] Write the conjugate acid for each of the following bases. *Watch the charges.*

a) $HSO_4^-$ $H_2SO_4$ b) $CH_3NH_2$ $CH_3NH_3^+$

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 6 and another has a pH of 2, 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 = 2 has a higher $[H^+]$, $[H^+] = 10^{-pH} = 1.0\times10^{-2}$ M, while the first solution has $[H^+] = 10^{-pH} = 1.0\times10^{-6}$ 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 $[H^+]$: $\frac{[H^+]_2}{[H^+]_1} = \frac{1.0\times10^{-2}}{1.0\times10^{-6}} = 10^4 = 10{,}000$.

**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. [4 pts] Calcium hydroxide, $Ca(OH)_2$ is a strong base. Determine the pH of a 0.0150 M solution of $Ca(OH)_2$.

$[OH^-] = 2[Ca(OH)_2 = 2(0.0150\ M) = 0.0300\ M$

$pOH = -\log(0.0300) = 1.53$

$pH = 14 - 1.53 = \boxed{12.47}$

*OR*

$[H^+] = \frac{1.0\times10^{-14}}{0.0300\ M} = 3.33\times10^{-13}\ M$

$pH = -\log(3.33\times10^{-13}) = \boxed{12.47}$

28. [4 pts] What are the $[H^+]$, pH, and pOH at 298 K of a solution with $[OH^-] = 4.2 \times 10^{-4}$ M? Is this solution **acidic, basic, or neutral**?

$$pOH = -\log[OH^-] = -\log(4.2\times10^{-4}) = \boxed{3.38}$$

$$pH = 14.00 - pOH = 14.00 - 3.38 = \boxed{10.62}$$

$$[H^+] = 10^{-pH} = 10^{-10.62} = \boxed{2.4\times10^{-11}\ \text{M}}$$

*OR*

$$[H^+] = \frac{1.0\times10^{-14}}{[OH^-]} = \frac{1.0\times10^{-14}}{4.2\times10^{-4}} = \boxed{2.4\times10^{-11}}$$

$$pH = -\log[H^+] = -\log(2.4\times10^{-11}) = \boxed{10.62}$$

$$\boxed{\text{Basic}}$$

29. [3 pts] Write a *balanced* neutralization equation for the following acid-base reaction:
$HNO_2$ (nitrous acid) and $Sr(OH)_2$ (strontium hydroxide)

$$2\ HNO_2\ (aq) + Sr(OH)_2 \rightarrow 2\ H_2O\ (l) + Sr(NO_2)_2\ (aq)$$

30. 15.0 mL of KOH solution was neutralized by 12.32 mL of 0.198 M HBr solution according to the balanced reaction,

$$HBr(aq) + KOH(aq) \rightarrow KBr(aq) + H_2O(l).$$

a. [3 pts] How many moles of KOH were neutralized by the HBr?

$$\text{mol KOH} = 0.01232\ \text{L HBr} \times \frac{0.198\ \text{mol}}{1\ \text{L}} \times \frac{1\ \text{mol KOH}}{1\ \text{mol HBr}} = \boxed{0.00244\ \text{mol KOH}}$$

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

$$[\text{KOH}] = \frac{0.00244\ \text{mol KOH}}{0.01500\ \text{L}} = \boxed{0.163\ \text{M}}$$

[1 pt extra credit]

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

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