Unit 10 – Acid Base

1. The pH of acids are less than 7, and bases are greater than 7. pH of pure water only 7 when temp. is 25°C.
2. Acids donate $[H^+]$; bases accept $[H^+]$.
3. The hydronium ion is H_3O^+. $[H^+]$ is a proton.
4. Strong acids: HNO_3 H_2SO_4 $HClO_4$ $HClO_3$ and HBr, HI, HCl…"NO SO ClO 3, 4, 4, 3 and BrICl"
5. Strong bases: Group 1 hydroxides Group 2 hydroxides *Some Group II hydroxides are only slightly soluble, but whatever dissolves can completely ionize.
6. $pH = -\log [H^+]$ $[H^+] = 10^{-pH}$
7. The stronger the acid, the weaker its conjugate base.
8. Acid-Base rxns favor the direction of the "strong side" to the "weak side." If K>1, reactants are stronger.
9. $[H^+] = \sqrt{M_aK_a}$…(This shortcut only works if "x" is really small compared to M_a . Don't use shortcut if you are given the pH of the solution and are asked to solve for K_a because the pH can be used to find "x" in the ICE box.)
10. "x" in the ice box calculation is $[H^+]$ for a weak acid, and $[OH^-]$ for a weak base.
11. % Ionization of a weak acid = $([H^+] / M_a) * 100$
12. % ionization increases as [acid] decreases. Adding more water will increase the amount of ionization.
13. If a salt contains a conjugate base of a weak acid, the salt will be slightly basic. CBOWA's are (-) ions.
14. If a salt contains a conjugate acid of a weak base, the salt will be slightly acidic. CAOWB's are (+) ions.
15. If a salt contains conjugates of strong acid/bases, the ion is neutral. KBr is a neutral salt (KOH + HBr)
16. A larger K_a value means a stronger acid. A larger K_b means a stronger base.
17. Relative strengths of acids: (a) Smaller cations=more acidic. (b) More (+) charge on the cation=more acidic. (c) More oxygens (or more electronegative atoms) on an anion = more acidic since the proton is "more ionizable".
18. Buffers are created by a weak acid + CB (salt) or by a weak base + CA (salt).
19. $[H^+] = M_aK_a/[salt]$...You can use # of moles instead of molarity in this formula.
20. Adding a common ion to a weak acid (or base) decreases the % ionization, so the pH gets closer to 7.
21. $M_aV_a=M_bV_b$ ...This is only true at the equivalence point.
22. $M_1V_1 = M_2V_2$ This is not on the formula sheet, but it is extremely useful for dilution calculations.
23. Titrations: Weak acid + Strong Base has a pH at the equivalence point that's above 7. Weak Base + Strong Acid has a pH at the equivalence point that's below 7. Strong Acid + Strong Base has a pH =7 at the equivalence point.
24. $pH = pK_a$ at the ½ equivalence point for a "weak + strong" titration. When pH = pKa, then $[HA] = [A^-]$
25. More buffer capacity = more moles of weak acid & CB (or weak base and CA).
26. Solubility Equilibrium: 2 ions....$K_{sp} = x^2$; 3 ions...$K_{sp} = 4x^3$ "x" = Molar Solubility in units of mol/L
27. The larger the "x" value, the more soluble the salt is.
28. If $Q > K_{sp}$, a precipitate forms.
29. Group I cations, NH_4^+, and NO_3^- salts are always soluble in water. Usually spectator ions in a chemical reaction.
30. Indicators should change color in the range of the eq. pt. The pKa of an indicator should be +/- 1 of the eq. pt pH

Thou Shalt Not Forget Questions

Credit: Dan Reid

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1. The pH of acids are _____ than 7.
   The pH of bases are _____ than 7.
2. Do acids donate or accept $[H^+]$ (protons)?
   Do bases donate or accept $[H^+]$ (protons)?
3. How do you make a hydronium ion?
4. Write the formula for the 6 strong acids.
5. Write the formulas for the strong bases.
6. a) If $[H^+] = 1 \times 10^{-x}$ what is the pH?
   b) If the pH = x, what is the $[H^+]$?
7. The stronger the acid, the _____ its conjugate base.
8. If K_{eq} is greater than 1, then which side of the reaction has the stronger acid and base?
   If K_{eq} is less than 1, then which side of the reaction has the stronger acid and base?
9. a) $\sqrt{M_aK_a}$ is equal to what variable?
   b) You CANNOT use $[H^+] = \sqrt{M_aK_a}$ if what is true about the acid?
10. "x" in the ice box calculation is equal to what ion for a weak acid? For a weak base?
11. % Ionization of a weak acid = _____
12. a) % ionization increases as the [acid] _____.
    It decreases as the [acid] _____.
    b) Will adding more water to a weak acid increase or decrease the % ionization?
13. a) Example of a salt that contains a CBOWA?
    b) CBOWA ions have what charge?
14. a) Example of a salt that contains a CAOWB?
    b) CAOWB ions have what charge?
15. a) If a salt contains conjugates of both a strong acid and strong base, the salt is _____.
    b) Give an example of a salt that is neutral.
16. Does a larger K_a / K_b value mean a stronger or weaker acid/base? A smaller K_a /K_b ?
17. a) Smaller cations are more or less acidic?
    b) More (+) charge on the cation makes it more or less acidic?
    c) More oxygens/more electronegative atoms on an anion makes it more or less acidic?
    d) List 2 things that make a cation more acidic.
18. Buffers have 2 general components. Name them.
19. a) M_aK_a/[salt] equals what variable?
    b) When using the formula $[H^+] = M_aK_a$/[salt], what units can you use instead of molarity for M_a and [salt]?
20. a) Adding a common ion to a weak acid/base decreases or increases the % ionization?
    b) Adding a common ion to a weak acid/base has what effect on the pH?
21. $M_aV_a=M_bV_b$ This is only true "when"/"where" in a titration?
22. a) $M_1V_1 = M_2V_2$ is used for what type of calculation?
    b) What formula do we use for dilution calculations?
23. a) Titrations: Weak acid + Strong Base has a pH at the equivalence point that's above or below or equal to 7?
    b) Weak Base + Strong Acid has a pH at the equivalence point that's above or below or equal to 7?
    c) Strong Acid + Strong Base has a pH at the equivalence point that's above or below or equal to 7?
24. a) pH = pK_a "when"/"where" in a titration?
    b) At the ½ equivalence point for a "weak + strong" titration, what 2 concentrations are equal?
    c) At the ½ equivalence point for a "weak + strong" titration, what does the pKa/pH equal?
25. Buffer capacity depends on what factor(s)?
26. a) 2 ions....K_{sp} = ? ; 3 ions...K_{sp} = ?
    b) For a K_{sp} ICE box, "x" refers to what value?
    c) What are the units for molar solubility?
27. What does the magnitude of K_{sp} (or the magnitude of "x" of a K_{sp} ICE box) tell us about the salt?
28. Will a precipitate form when Q is less than or greater than K_{sp}?
29. List the symbols of the most common spectator cations and anion in a chemical reaction.
30. How do you choose an appropriate indicator for a titration?