**Acids and Bases – Formula Sheet:**

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| **Arrhenius Definition:**   * Acids produce H+ ions in solutions. * Bases produce OH- ions in solutions.   **Bronsted-Lowry Definition:**   * Acids are proton donors. * Bases are proton acceptors.   **Lewis Definition:**   * Acids are electron pair acceptors. * Bases are electron pair donors. | **Acid-Base Equations: (0.1 M HCl or 0.15M KOH)** |
| **Strong Acids:**  HCl / HBr / HI / HNO3 / HClO4 / H2SO4  **Weak Acids:**  HF / HNO2 / HClO / HCN / HC2H3O2  **Strong Bases:** NaOH / KOH **Weak Bases**: NH3 | **Autoionization of Water:** |
| **pH of a Weak Base: (0.25 M NH3)**  If < 1 x 10-4, then | **pH of a Weak Acid: (0.5M HC2H3O2)**  If **Ka** < 1 x 10-4, then |
| |  |  |  | | --- | --- | --- | | **Acidic Ions:** | **Neutral Ions:** | **Weak Basic Ions:** | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  |   **Strong Base Ions:** | **Percent Ionization for Acids:**  **Percent Ionization for Bases:** |

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| |  |  | | --- | --- | | **Acid:** | **Ka Value:** | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | |  |  | | **Acid-Base Dissociation Constant Equations:** |
| **Note:** A buffer solution is made up of a weak acid and its conjugate weak base. Buffer solutions resist changes to its pH.  **Examples of Buffer Solutions:**   1. HF / NaF 2. NH4Cl / NH3 3. HC2H3O2 / NaC2H3O2 | **pH - Buffer Solution**: **(0.5M NH4Cl / 0.4M NH3)**  Henderson-Hasselbalch Equation:  **Note:** |
| **Dissociation Constants for H3PO4**   |  |  | | --- | --- | |  |  | |  |  | |  |  |   **Note:** The 1st step is most important for calculating the pH of the solution: | **pH of a Polyprotic Acid:** **(0.25M H3PO4)**  ------------------------------------------------------------- |
| **Amphoteric Ion Reactions in Water:** | **pH of an Amphoteric Salt:** **(0.4M NaH2PO4)** |

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| **Standard Form of a Quadratic Equation:**  **The Quadratic Formula:**  **Dilution Formula:**  **Moles:** | **pH of a Weak Acid / Weak Base Salt**: **(0.2M NH4F)** |
| |  |  | | --- | --- | | **Titration:** | **pH at Equiv. point** | | Strong Acid – Strong Base | pH = 7 | | Weak Acid – Strong Base | pH > 7 | | Weak Base – Strong Acid | pH < 7 | | **Acid-Base Titrations:**   * ICE Tables – Use Molarity * BCA Tables – Use Moles   **At ½ Veq (Equivalence Volume):** |
| **Acid-Base Indicators:**   |  |  |  |  | | --- | --- | --- | --- | | **Indicator:** |  |  |  | | **Methyl Orange** |  |  |  | | **Methyl Red** |  |  |  | | **Bromthymol Blue** |  |  |  | | **Phenolphthalein** |  |  |  | | |