

The Relationship between K_a , K_b and K_w : pHun with math!

Between any acid/conjugate base pair, the following relationships will always be true:

$$K_w = K_a \times K_b$$
$$K_w = [H^+][OH^-] = 1.0 \times 10^{-14} \quad \text{at } 25^\circ\text{C}$$

] on formula sheet!

And because of yummy math, this means:

$$-\log K_w = -\log K_a - \log K_b$$
$$14 = pK_a + pK_b \quad \text{at } 25^\circ\text{C}$$

} Not on F.C.

Example 1: The K_a for HCO_3^- is 4.7×10^{-11} . What is the conjugate base and the value of K_b and pK_b ?

Conjugate base = CO_3^{2-}

$$K_b = \frac{K_w}{K_a} = \frac{1 \text{E-}14}{4.7 \text{E-}11} = \boxed{2.1 \times 10^{-4}}$$

$$pK_b = -\log(2.1 \text{E-}4) = \boxed{3.67}$$

Example 2: The pK_b for CN^- is 4.80. What is the conjugate acid and its K_a value?

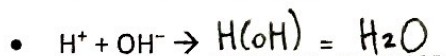
Conjugate acid = $\boxed{\text{HCN}}$

$$pK_a = 14 - pK_b = 14 - 4.80 = 9.20$$

$$K_a = 10^{-pK_a} = 10^{-9.20} = \boxed{6.3 \times 10^{-10}}$$

Neutralization Reactions

Neutralization reaction: when an Arrhenius acid and base react to produce a salt and water

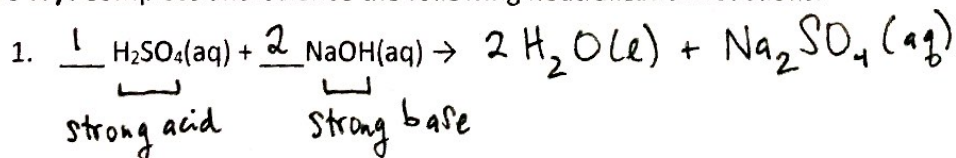


General Neutralization Reaction: $\text{HX(aq)} + \text{MOH(aq)} \rightarrow \text{H}_2\text{O(l)} + \text{MX(aq)}$

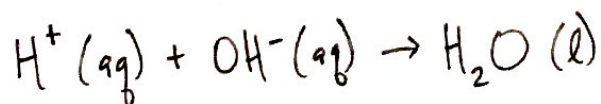
acid + base \rightarrow water + salt

Net Ionic:

Let's Try! Complete and balance the following neutralization reactions.



2. What is the net ionic for the reaction shown above?



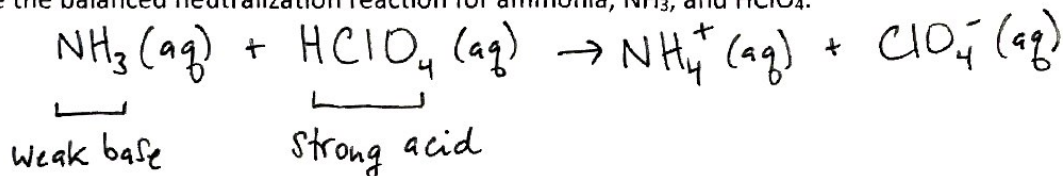
Net Ionic Equations for Weak/Strong Neutralization Reactions

In the net ionic equation for a weak acid/base + a strong base/acid,
the **weak** species will NOT dissociate!

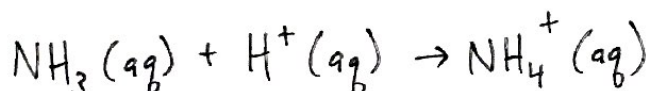
Wait, but why? Remember that a weak species is defined to be weak BECAUSE it doesn't dissociate in solution, so we need to accurately represent that in our net ionic equation.

*Note about arrows: if **either** the acid or base reactant is **strong**, use a **one-way** (completion) arrow. Otherwise, use an equilibrium (both ways) arrow. aka both weak
⇌

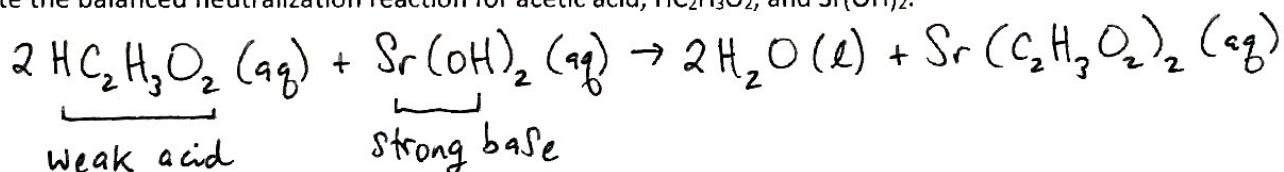
3. Write the balanced neutralization reaction for ammonia, NH_3 , and HClO_4 .



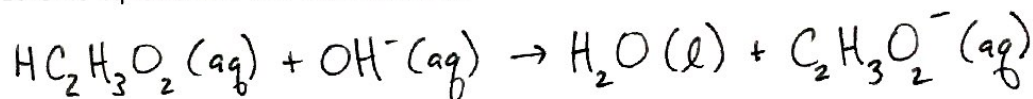
4. What is the net ionic equation for the reaction in #2?



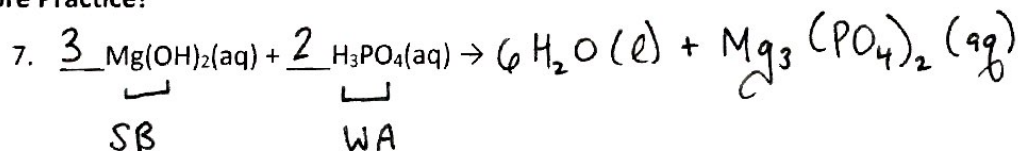
5. Write the balanced neutralization reaction for acetic acid, $\text{HC}_2\text{H}_3\text{O}_2$, and $\text{Sr}(\text{OH})_2$.



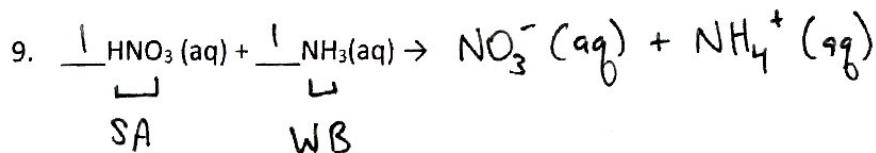
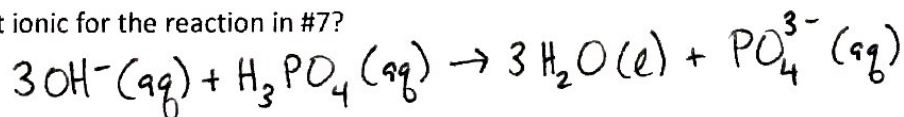
6. What is the net ionic equation for the reaction in #5?



More Practice!



8. What is the net ionic for the reaction in #7?



10. What is the net ionic for the reaction in #9?

