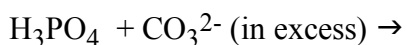
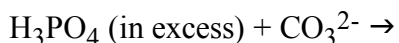
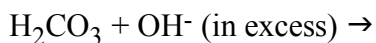
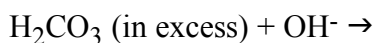
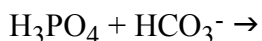
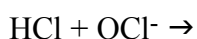


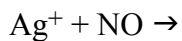
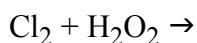
## Equilibrium Constants for Selected Acids and Bases

	Conjugate Acid	$K_a = K_w/K_b$	$K_b = K_w/K_a$	Conjugate Base	
Strong Acids	HCl	$1 \times 10^6$	$1 \times 10^{-20}$	$\text{Cl}^-$	Neutral Bases
	$\text{HNO}_3$	28	$2.6 \times 10^{-16}$	$\text{NO}_3^-$	
	$\text{H}_3\text{O}^+$	1	$1 \times 10^{-14}$	$\text{H}_2\text{O}$	
Weak Acids	$\text{H}_3\text{PO}_4$	$7.1 \times 10^{-3}$	$1.4 \times 10^{-12}$	$\text{H}_2\text{PO}_4^-$	Weak Bases
	HCOOH	$1.8 \times 10^{-4}$	$5.6 \times 10^{-11}$	$\text{HCOO}^-$	
	$\text{C}_6\text{H}_5\text{COOH}$	$6.3 \times 10^{-5}$	$1.3 \times 10^{-10}$	$\text{C}_6\text{H}_5\text{COO}^-$	
	$\text{CH}_3\text{COOH}$	$1.75 \times 10^{-5}$	$5.7 \times 10^{-10}$	$\text{CH}_3\text{COO}^-$	
	$\text{H}_2\text{CO}_3$	$4.5 \times 10^{-7}$	$2.2 \times 10^{-8}$	$\text{HCO}_3^-$	
	$\text{H}_2\text{PO}_4^-$	$6.3 \times 10^{-8}$	$1.6 \times 10^{-7}$	$\text{HPO}_4^{2-}$	
	HOCl	$2.9 \times 10^{-8}$	$3.4 \times 10^{-7}$	$\text{OCl}^-$	
	$\text{NH}_4^+$	$5.6 \times 10^{-10}$	$1.8 \times 10^{-5}$	$\text{NH}_3$	
	$\text{HCO}_3^-$	$4.7 \times 10^{-11}$	$2.1 \times 10^{-4}$	$\text{CO}_3^{2-}$	
	$\text{HPO}_4^{2-}$	$4.2 \times 10^{-13}$	$2.4 \times 10^{-2}$	$\text{PO}_4^{3-}$	
	$\text{H}_2\text{O}$	$1 \times 10^{-14}$	1	$\text{OH}^-$	
Neutral Acids	$\text{NH}_3$	-	-	$\text{NH}_2^-$	Strong Bases



## Standard State Reduction Potentials for Selected Oxidizing Agents and Reducing Agents

	Conjugate Oxidizing Agent	$E^{\circ}_{\text{red}}$	Conjugate Reducing Agent	
Strong Oxidizing Agents	$\text{MnO}_4^-$	1.679	$\text{MnO}_2$	Neutral Reducing Agents
	$\text{MnO}_4^-$	1.491	$\text{Mn}^{2+}$	
	$\text{Cl}_2$	1.3581	$\text{Cl}^-$	
	$\text{Cr}_2\text{O}_7^{2-}$	1.33	$\text{Cr}^{3+}$	
	$\text{O}_2$	1.229	$\text{H}_2\text{O}$	
Weak Oxidizing Agents	$\text{Br}_2$	1.087	$\text{Br}^-$	Weak Reducing Agents
	$\text{HNO}_3$	0.96	$\text{NO}$	
	$\text{Ag}^+$	0.7996	$\text{Ag}$	
	$\text{O}_2$	0.682	$\text{H}_2\text{O}_2$	
	$\text{MnO}_4^-$	0.588	$\text{MnO}_2$	
	$\text{O}_2$	0.401	$\text{OH}^-$	
	$\text{H}^+$	0.000...	$\text{H}_2$	
Neutral Oxidizing Agents	$\text{Co}^{2+}$	-0.28	$\text{Co}$	Strong Oxidizing Agents
	$\text{Zn}^{2+}$	-0.7628	$\text{Zn}$	
	$\text{K}^+$	-2.924	$\text{K}$	



A few years ago a spill of potassium permanganate,  $\text{KMnO}_4$ , occurred in Greencastle. Dave Roberts, volunteer fire fighter and DePauw Storeroom Manager, treated the spill using sodium bisulfate,  $\text{NaHSO}_3$ . Knowing that  $K_a$  for  $\text{HMnO}_4$  is 0.50 and that  $K_a$  for  $\text{HSO}_3^-$  is  $6.4 \times 10^{-8}$ , and that  $E^{\circ}$  for  $\text{MnO}_4^-/\text{Mn}^{2+}$  is 1.49 V and that  $E^{\circ}$  for  $\text{SO}_4^{2-}/\text{HSO}_3^-$  is 0.049 V, is the unbalanced reaction involved

