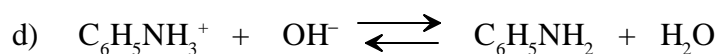
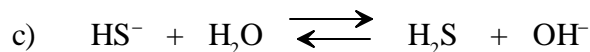
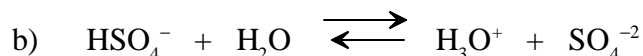
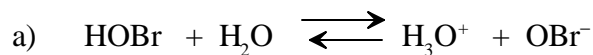


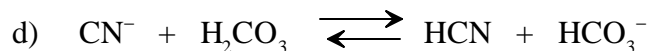
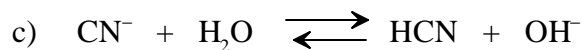
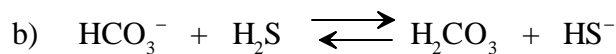
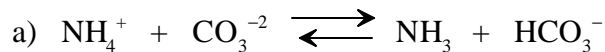
CHEM 132
Problem Set Ch.15

[Key Begins on Page 3.](#)

1. For each of the following, identify the **acids** and **bases** involved in both the forward and reverse directions



2. Use table 15.2 in your text to determine whether the species on the **left** or those on the **right** are favored by the reaction.



3. Calculate the $[\text{H}^+]$ and $[\text{OH}^-]$ for each of the following solutions.

	$[\text{H}^+]$	$[\text{OH}^-]$
a) 0.0060 M HCl	_____	_____
b) 0.082 M NaOH	_____	_____
c) 4.2×10^{-3} M HNO_3	_____	_____

4. The following are solution concentrations. State whether each is **acidic**, **neutral** or **basic**.



5. Obtain the **pH** corresponding to the following concentrations.

a) $1.0 \times 10^{-4} \text{ M H}^+$ _____ c) $2.3 \times 10^{-5} \text{ M OH}^-$ _____

b) $2.91 \times 10^{-11} \text{ M H}^+$ _____ d) $3.2 \times 10^{-10} \text{ M OH}^-$ _____

6. A sample of wine was found to have a pH of 3.85. Calculate the **[H⁺]** and **[OH⁻]**.

[OH⁻] = _____

[H⁺] = _____

7. List the following compounds in order of **increasing** acidity. **Explain your reasoning.**

HBrO_2 HClO_2 HBrO

8. Predict whether each of the following aqueous solutions is **acidic**, **basic**, or **neutral**.

a) KCl _____ c) NH_4NO_3 _____

b) NaNO_2 _____ d) NaI _____

9. A 1.00 L aqueous solution contains 6.78 g of Barium hydroxide, Ba(OH)_2 . What was the **pH** of the solution at 25°C?

pH = _____

10. A 2.500-g sample of a mixture of sodium chloride and sodium carbonate is dissolved in 25.00 mL of 0.798 M HCl . Some acid remains after the treatment of the sample.

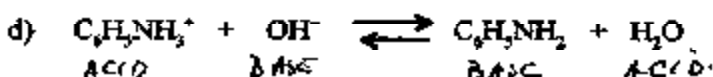
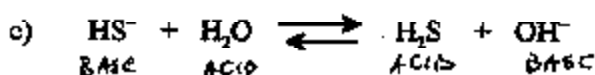
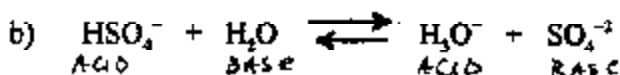
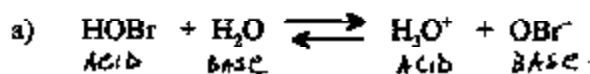
a) Write a **net ionic equation** for the complete reaction of sodium carbonate with hydrochloric acid.

b) If 28.7 mL of 0.108 M NaOH were required to titrate the excess hydrochloric acid, **how many moles** of sodium carbonate were present in the original sample?

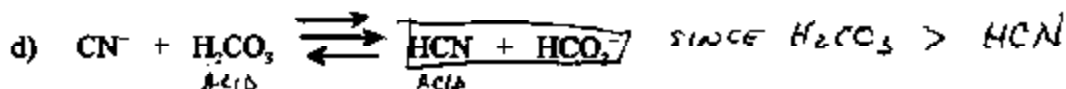
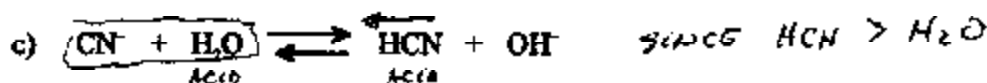
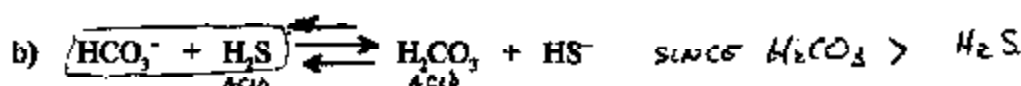
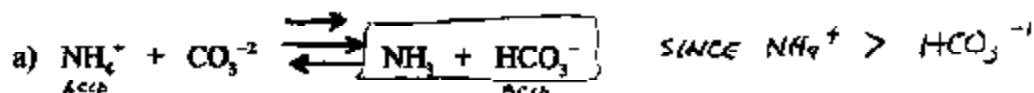
CHEM 132

Problem Set Ch.15

1. For each of the following, identify the acids and bases involved in both the forward and reverse directions



2. Use table 15.2 in your text to determine whether the species on the left or those on the right are favored by the reaction.



3. Calculate the $[\text{H}^+]$ and $[\text{OH}^-]$ for each of the following solutions.

	$[\text{H}^+]$	$[\text{OH}^-]$
a) 0.0060 M HCl	0.006	1.67×10^{-12}
b) 0.082 M NaOH	1.22×10^{-13}	0.082
c) 4.2×10^{-3} M HNO ₃	0.0042	2.38×10^{-12}

4. The following are solution concentrations. State whether each is acidic, neutral or basic.

a) 2×10^{-4} M OH ⁻ pH = 10.3	BASIC	c) 6×10^{-10} M OH ⁻ pH = 4.8	ACIDIC
b) 2×10^{-6} M H ⁺ pH = 5.7	ACIDIC	d) 6×10^{-9} M H ⁺ pH = 9.2	BASIC

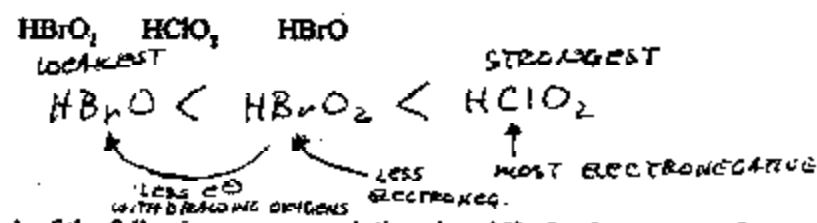
5. Obtain the pH corresponding to the following concentrations. $pH = -\log[H^+] = -\log \frac{1 \times 10^{-14}}{[OH^-]}$

- a) $1.0 \times 10^{-4} M H^+$ 4 c) $2.3 \times 10^{-3} M OH^-$ 9.4
 b) $2.91 \times 10^{-11} M H^+$ 10.5 d) $3.2 \times 10^{-10} M OH^-$ 4.5

6. A sample of wine was found to have a pH of 3.85. Calculate the $[H^+]$ and $[OH^-]$

$pH = 3.85$
 $[H^+] = 10^{-3.85} = 1.41 \times 10^{-4}$ $[OH^-] = \frac{1 \times 10^{-14}}{1.41 \times 10^{-4}} = 7.1 \times 10^{-11}$
 $[OH^-] = \frac{1 \times 10^{-14}}{[H^+]} = \frac{1 \times 10^{-14}}{1.41 \times 10^{-4}} = 7.1 \times 10^{-11}$ $[H^+] = \frac{1 \times 10^{-14}}{7.1 \times 10^{-11}} = 1.41 \times 10^{-4}$

7. List the following compounds in order of increasing acidity. Explain your reasoning.



8. Predict whether each of the following aqueous solutions is acidic, basic, or neutral.

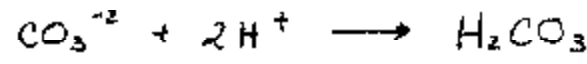
- a) KCl SKIP c) NH_4NO_3 _____
 b) $NaNO_2$ THIS QUESTION d) NaI WILL BE COVERED IN CH. 16.

9. A 1.00 L aqueous solution contains 6.78 g of Barium hydroxide, $Ba(OH)_2$. What was the pH of the solution at 25°C?

$6.78 g Ba(OH)_2 \left(\frac{1 mol}{171.3 g} \right) \left(\frac{2 mol OH^-}{1 mol Ba(OH)_2} \right) = 0.0792 mol OH^-$ in 1.0 L
 $[OH^-] = 0.0792 M$ $[H^+] = \frac{1 \times 10^{-14}}{0.0792} = 1.26 \times 10^{-13}$ $pH = -\log(1.26 \times 10^{-13}) = 12.9$

10. A 2.500-g sample of a mixture of sodium chloride and sodium carbonate is dissolved in 25.00 mL of 0.798 M HCl. Some acid remains after the treatment of the sample.

a) Write a net ionic equation for the complete reaction of sodium carbonate with hydrochloric acid.



b) If 28.7 mL of 0.108 M NaOH were required to titrate the excess hydrochloric acid, how many moles of sodium carbonate were present in the original sample?

TOTAL HCl used = $(0.025 L)(0.798 \frac{mol}{L}) = 0.01995 mol HCl$ TOTAL
 EXCESS HCl = moles NaOH used to TITRATE EXCESS = $(0.0287 L)(0.108 \frac{mol}{L}) = 0.00310 mol HCl$ LEFT-OVER
 SUBTRACT 0.01685 mol HCl REACTED
 $(0.01685 mol HCl REACTED) \left(\frac{1 mol Na_2CO_3}{2 mol HCl} \right) = 0.00843 mol Na_2CO_3$ PRESENT