SCH3U Worksheet

Acid-Base Chemistry Review

1. Solutions of nitrous acid, $HNO_{2(aq)}$, and nitric acid, $HNO_{3(aq)}$, with equal concentrations are tested for their pH, conductivity, and reactivity with magnesium metal, $Mg_{(s)}$, and the results are tabulated (see **Table 1**).

Table 1. Physical and chemical properties of aqueous hydrogen halides

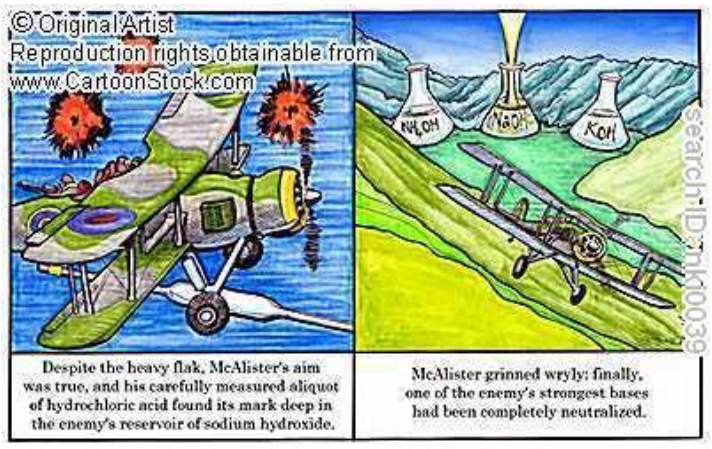
Solution	Conductivity	Reactivity	pH
0.10 mol/L nitrous acid, $HNO_{2(aq)}$	low; bulb is dim	produces gentle bubbling around surface of metal; after 20 minutes, metal is still reacting in the solution	3.00
0.10 mol/L nitric acid, $HNO_{3(aq)}$	high; bulb glows bright	vigorous bubbling occurs on the surface of metal; within a minute, metal has been completely consumed by reaction	1.00

   a. Explain the difference in the empirical evidence from the tests of the nitrous acid and nitric acid solutions based on Arrhenius theory.
   b. Write a net ionic equation to show the reaction of nitric acid, $HNO_{3(aq)}$, with magnesium, $Mg_{(s)}$.
   c. Using the pH value that is recorded, determine the concentration of hydrogen ions, $[H^+]$, in 0.10 mol/L nitrous acid solution, $HNO_{2(aq)}$, and find the percent ionization of this acid.

2. For a chemistry demonstration, an acidic solution with pH of 1.30 will be needed. In the storage room, there is a bottle containing 100.0 mL of 0.50 mol/L aqueous hydrochloric acid, $HCl_{(aq)}$.
   a. Given that $HCl_{(aq)}$ is a strong acid, what final concentration will be required to prepare an acidic solution with a pH of 1.30?
   b. Calculate the amount of water that should be added to dilute the 0.50 mol/L aqueous hydrochloric acid to the necessary pH.

3. Baking soda is an ionic compound with the chemical formula, $NaHCO_{3(s)}$. Also known as sodium bicarbonate (or sodium hydrogen carbonate), it is highly soluble in water at SATP conditions.
   a. Write the dissociation equation to show $NaHCO_{3(s)}$ dissolving in water.

   Baking soda is known to produce basic aqueous solutions, but other sodium compounds do not (e.g. $NaCl_{(aq)}$).
   b. What ion must be present in a basic aqueous solution?
   c. Demonstrate how bicarbonate ions, $HCO_3^{-1}{}_{(aq)}$, produce basic aqueous solutions using a balanced chemical equation.



4. Students in the grade 12 chemistry class had prepared soap as part of a class project on hygiene. However, after the procedure, they had 250 mL of aqueous sodium hydroxide, $NaOH_{(aq)}$, leftover. Since the solution was very concentrated at 6.0 mol/L, they were instructed not to pour this directly into the sink. Instead they were asked to neutralize the sodium hydroxide with aqueous sulfuric acid, $H_2SO_{4(aq)}$.
   a. Write the balanced chemical equation for the reaction between sodium hydroxide and sulfuric acid.
   b. Determine what volume of 0.50 mol/L $H_2SO_{4(aq)}$ will be required to ensure complete neutralization of the remaining sodium hydroxide.