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AP Chemistry – Strong and Weak Acids – 49

Name _____Per ___

1. The active ingredient in aspirin is acetylsalicylic acid, $HC_9H_7O_4$, a monoprotic acid with $K_a = 3.3 \times 10^{-4}$ at $25^{\circ C}$. What is the pH of a solution obtained by dissolving two extra-strength aspirin tablets, containing 500. mg of acetylsalicylic acid each, in 250. mL of water?

2. Codeine, $C_{18}H_{21}NO_3$, is a weak organic base. A 5.0×10^{-3} M solution of codeine has a pH of 9.95. Calculate the value of K_b for this substance.

3. Write the equilibrium-constant expression and calculate the value of the equilibrium constant at 298 K for the reaction $2HBr_{(g)} + Cl_{2(g)} \leftrightarrow 2HCl_{(g)} + Br_{2(g)}$

4. The K_b for ammonia is 1.8×10^{-5} and for hydroxylamine is 1.1×10^{-8}. (a)Which is the stronger base? Why?

(b) Which is the stronger acid, the ammonium ion, NH_4^+ or the hydroxylammonium ion, H_3NOH^+?

(c) Calculate the K_a values for NH_4^+ and H_3NOH^+.

5. NaF is a soluble salt and thus a strong electrolyte. When it is dissolved in water it dissociates completely into Na^+ and F^-. Na^+ is the conjugate acid of the strong base NaOH and thus does not influence the pH. The F^- on the other hand, is the conjugate base of the weak acid HF, $K_a = 6.8 \times 10^{-4}$ and does influence the pH of the solution. Like any other weak base, F^- will hydrolyze water to produce OH^-. Determine the $[OH^-]$ and the pH of a 0.036 M NaF solution.

6. Which member of each pair produces the more acidic aqueous solution? Explain?
(a) $ZnBr_2$ or $CdCl_2$

(b) CuCl or $Cu(NO_3)_2$

(c) $Ca(NO_3)_2$ or $NiBr_2$

7. A 1.452 g sample of limestone rock is pulverized and then treated with 25.00 mL of 1.035 HCl solution. The excess acid then required 15.25 mL of 0.1010 M NaOH for neutralization. Calculate the percent by mass of calcium carbonate in the rock, assuming that it is the only substance reacting with the HCl solution.

8. The commercial production of nitric acid involves the following chemical reactions:

$4NH_{3(g)} + 5O_{2(g)} \rightarrow 4NO_{(g)} + 6H_2O_{(g)}$

$2NO_{(g)} + O_{2(g)} \rightarrow 2NO_{2(g)}$

$3NO_{2(g)} + H_2O_{(l)} \rightarrow 2HNO_{3(aq)} + NO_{(g)}$ (a) Which of these reactions are redox reactions?

(b) In each redox reaction, identify the element undergoing oxidation and the element undergoing reduction.

9. Titanium(IV) ion can be reduced to Titanium(III) ion by careful addition of zinc metal. Write the balanced net ionic equation for this process. Check to see that it is balanced by adding a spectator anion to titanium or check for conservation of charge.

10. Using modern analytical techniques it is possible to detect sodium ions in concentrations as low as 50 picograms/mL. Express this as a molarity.