

2005 AP[®] CHEMISTRY FREE-RESPONSE QUESTIONS (Form B)

CHEMISTRY

Section II

(Total time—90 minutes)

Part A

Time—40 minutes

YOU MAY USE YOUR CALCULATOR FOR PART A.

CLEARLY SHOW THE METHOD USED AND THE STEPS INVOLVED IN ARRIVING AT YOUR ANSWERS. It is to your advantage to do this, since you may obtain partial credit if you do and you will receive little or no credit if you do not. Attention should be paid to significant figures.

Be sure to write all your answers to the questions on the lined pages following each question in this booklet. Do NOT write your answers on the lavender insert.

Answer Question 1 below. The Section II score weighting for this question is 20 percent.

$$K_a = \frac{[\text{H}_3\text{O}^+][\text{OCl}^-]}{[\text{HOCl}]} = 3.2 \times 10^{-8}$$

1. Hypochlorous acid, HOCl, is a weak acid in water. The K_a expression for HOCl is shown above.
 - (a) Write a chemical equation showing how HOCl behaves as an acid in water.
 - (b) Calculate the pH of a 0.175 *M* solution of HOCl.
 - (c) Write the net ionic equation for the reaction between the weak acid HOCl(*aq*) and the strong base NaOH(*aq*).
 - (d) In an experiment, 20.00 mL of 0.175 *M* HOCl(*aq*) is placed in a flask and titrated with 6.55 mL of 0.435 *M* NaOH(*aq*).
 - (i) Calculate the number of moles of NaOH(*aq*) added.
 - (ii) Calculate $[\text{H}_3\text{O}^+]$ in the flask after the NaOH(*aq*) has been added.
 - (iii) Calculate $[\text{OH}^-]$ in the flask after the NaOH(*aq*) has been added.