

**2010 AP<sup>®</sup> CHEMISTRY FREE-RESPONSE QUESTIONS**

**CHEMISTRY**

**Section II**

**(Total time—95 minutes)**

**Part A**

**Time—55 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 the booklet with the pink cover. Do NOT write your answers on the green insert.

Answer Questions 1, 2, and 3. The Section II score weighting for each question is 20 percent.

1. Several reactions are carried out using AgBr, a cream-colored silver salt for which the value of the solubility-product constant,  $K_{sp}$ , is  $5.0 \times 10^{-13}$  at 298 K.
  - (a) Write the expression for the solubility-product constant,  $K_{sp}$ , of AgBr.
  - (b) Calculate the value of  $[Ag^+]$  in 50.0 mL of a saturated solution of AgBr at 298 K.
  - (c) A 50.0 mL sample of distilled water is added to the solution described in part (b), which is in a beaker with some solid AgBr at the bottom. The solution is stirred and equilibrium is reestablished. Some solid AgBr remains in the beaker. Is the value of  $[Ag^+]$  greater than, less than, or equal to the value you calculated in part (b) ? Justify your answer.
  - (d) Calculate the minimum volume of distilled water, in liters, necessary to completely dissolve a 5.0 g sample of AgBr(s) at 298 K. (The molar mass of AgBr is  $188 \text{ g mol}^{-1}$ .)
  - (e) A student mixes 10.0 mL of  $1.5 \times 10^{-4} \text{ M AgNO}_3$  with 2.0 mL of  $5.0 \times 10^{-4} \text{ M NaBr}$  and stirs the resulting mixture. What will the student observe? Justify your answer with calculations.
  - (f) The color of another salt of silver, AgI(s), is yellow. A student adds a solution of NaI to a test tube containing a small amount of solid, cream-colored AgBr. After stirring the contents of the test tube, the student observes that the solid in the test tube changes color from cream to yellow.
    - (i) Write the chemical equation for the reaction that occurred in the test tube.
    - (ii) Which salt has the greater value of  $K_{sp}$ : AgBr or AgI ? Justify your answer.