

## 2003 AP<sup>®</sup> CHEMISTRY FREE-RESPONSE QUESTIONS

Answer EITHER Question 2 below OR Question 3 printed on page 8. Only one of these two questions will be graded. If you start both questions, be sure to cross out the question you do not want graded. The Section II score weighting for the question you choose is 20 percent.

2. A rigid 5.00 L cylinder contains 24.5 g of  $\text{N}_2(\text{g})$  and 28.0 g of  $\text{O}_2(\text{g})$ .
- (a) Calculate the total pressure, in atm, of the gas mixture in the cylinder at 298 K.
  - (b) The temperature of the gas mixture in the cylinder is decreased to 280 K. Calculate each of the following.
    - (i) The mole fraction of  $\text{N}_2(\text{g})$  in the cylinder
    - (ii) The partial pressure, in atm, of  $\text{N}_2(\text{g})$  in the cylinder
  - (c) If the cylinder develops a pinhole-sized leak and some of the gaseous mixture escapes, would the ratio  $\frac{\text{moles of } \text{N}_2(\text{g})}{\text{moles of } \text{O}_2(\text{g})}$  in the cylinder increase, decrease, or remain the same? Justify your answer.

A different rigid 5.00 L cylinder contains 0.176 mol of  $\text{NO}(\text{g})$  at 298 K. A 0.176 mol sample of  $\text{O}_2(\text{g})$  is added to the cylinder, where a reaction occurs to produce  $\text{NO}_2(\text{g})$ .

- (d) Write the balanced equation for the reaction.
- (e) Calculate the total pressure, in atm, in the cylinder at 298 K after the reaction is complete.