

## 2019 AP<sup>®</sup> CHEMISTRY FREE-RESPONSE QUESTIONS

4. A student is doing experiments with  $\text{CO}_2(g)$ . Originally, a sample of the gas is in a rigid container at 299 K and 0.70 atm. The student increases the temperature of the  $\text{CO}_2(g)$  in the container to 425 K.
- (a) Describe the effect of raising the temperature on the motion of the  $\text{CO}_2(g)$  molecules.
  - (b) Calculate the pressure of the  $\text{CO}_2(g)$  in the container at 425 K.
  - (c) In terms of kinetic molecular theory, briefly explain why the pressure of the  $\text{CO}_2(g)$  in the container changes as it is heated to 425 K.
  - (d) The student measures the actual pressure of the  $\text{CO}_2(g)$  in the container at 425 K and observes that it is less than the pressure predicted by the ideal gas law. Explain this observation.