

SAMPLE PROBLEM B

Oxygen gas from the decomposition of potassium chlorate, KClO_3 , was collected by water displacement. The barometric pressure and the temperature during the experiment were 731.0 torr and 20.0°C , respectively. What was the partial pressure of the oxygen collected?

SOLUTION

- 1 ANALYZE** Given: $P_T = P_{\text{atm}} = 731.0$ torr
 $P_{\text{H}_2\text{O}} = 17.5$ torr (vapor pressure of water at 20.0°C , from Table A-8)
 $P_{\text{atm}} = P_{\text{O}_2} + P_{\text{H}_2\text{O}}$
Unknown: P_{O_2} in torr
- 2 PLAN** The partial pressure of the collected oxygen is found by subtracting the partial pressure of water vapor from the atmospheric pressure, according to Dalton's law of partial pressures.
- $$P_{\text{O}_2} = P_{\text{atm}} - P_{\text{H}_2\text{O}}$$
- 3 COMPUTE** Substituting values for P_{atm} and $P_{\text{H}_2\text{O}}$ gives P_{O_2} .
- $$P_{\text{O}_2} = 731.0 \text{ torr} - 17.5 \text{ torr} = 713.5 \text{ torr}$$
- 4 EVALUATE** As expected, the oxygen partial pressure is less than atmospheric pressure. It is reasonably close to an estimated value of 713, calculated as $730 - 17$.

PRACTICE

Answers in Appendix E

1. Some hydrogen gas is collected over water at 20.0°C . The levels of water inside and outside the gas-collection bottle are the same. The partial pressure of hydrogen is 742.5 torr. What is the barometric pressure at the time the gas is collected?

extension

Go to go.hrw.com for more practice problems that ask you to calculate partial pressure.



Keyword: HC6GASX

SECTION REVIEW

1. Define *pressure*.
2. What units are used to express pressure measurements?
3. What are standard conditions for gas measurements?
4. Convert the following pressures to pressures in standard atmospheres:
a. 151.98 kPa b. 456 torr
5. A sample of nitrogen gas is collected over water at a temperature of 23.0°C . What is the pressure of the nitrogen gas if atmospheric pressure is 785 mm Hg?
6. Why can you calculate the total pressure of a mixture of gases by adding together the partial pressures of the component gases?

Critical Thinking

- 7. EVALUATING METHODS** Clean rooms used for sterile biological research are sealed and operate at slightly above atmospheric pressure. Explain why.
- 8. INFERRING RELATIONSHIPS** Explain why helium-filled balloons deflate over time faster than air-filled balloons do.