CHAPTER 11 REVIEW

Gases

MIXED REVIEW

SHORT ANSWER  Answer the following questions in the space provided.

1. Consider the following data table:

<table>
<thead>
<tr>
<th>Approximate pressure (kPa)</th>
<th>Altitude above sea level (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0 (sea level)</td>
</tr>
<tr>
<td>50</td>
<td>5.5 (peak of Mt. Kilimanjaro)</td>
</tr>
<tr>
<td>25</td>
<td>11 (jet cruising altitude)</td>
</tr>
<tr>
<td>&lt; 0.1</td>
<td>22 (ozone layer)</td>
</tr>
</tbody>
</table>

a. Explain briefly why the pressure decreases as the altitude increases.

As the altitude increases, there are fewer gas molecules above; therefore, there are fewer gas molecules to exert their pressure.

b. A few places on Earth are below sea level (the Dead Sea, for example). What would be true about the average atmospheric pressure there?

It would exceed 100 kPa at places below sea level.

2. Explain how the ideal gas law can be simplified to give Avogadro’s law, expressed as \( \frac{V}{n} = k \), when the pressure and temperature of a gas are held constant.

Rearrange \( PV = nRT \) to obtain \( \frac{V}{n} = \frac{RT}{P} \). Because every value for \( \frac{RT}{P} \) is the same, its overall value is constant; therefore, \( \frac{V}{n} = k \).

PROBLEMS  Write the answer on the line to the left. Show all your work in the space provided.

3. Convert a pressure of 0.400 atm to the following units:

   - 304 a. torr
   - 4.05 \times 10^4 b. Pa
MIXED REVIEW continued

4. **226 mL**  A 250. mL sample of gas is collected at 57°C. What volume will the gas sample occupy at 25°C?

5. **0.7 L**  H₂ reacts according to the following equation representing the synthesis of ammonia gas:

\[
\text{N}_2(g) + 3\text{H}_2(g) \rightarrow 2\text{NH}_3(g)
\]

If 1 L of H₂ is consumed, what volume of ammonia will be produced at constant temperature and pressure, based on Gay-Lussac's law of combining volumes?

6. **3.15 \times 10^3 \text{kPa}**  A 7.00 L sample of argon gas at 420. K exerts a pressure of 625 kPa. If the gas is compressed to 1.25 L and the temperature is lowered to 350. K, what will be its new pressure?

7. **2.1 \times 10^3 \text{L}**  Chlorine in the upper atmosphere can destroy ozone molecules, O₃. The reaction can be represented by the following equation:

\[
\text{Cl}_2(g) + 2\text{O}_3(g) \rightarrow 2\text{ClO}(g) + 2\text{O}_2(g)
\]

How many liters of ozone can be destroyed at 220. K and 5.0 kPa if 200.0 g of chlorine gas react with it?

8. **32 \text{ g/mol}**  A gas of unknown molar mass is observed to effuse through a small hole at one-fourth the effusion rate of hydrogen. Estimate the molar mass of this gas. (Round the molar mass of hydrogen to two significant figures.)