

Gas laws and particle motion

AP Chemistry · Lab answers

Model answers use the sample data. Your own values may differ slightly, but the method does not change: subtract the vapour pressure of water, convert to kelvin and keep units consistent. Give results to three significant figures.

Level: AP Chemistry · **Curriculum:** AP Chem Unit 3

Question 1 Write the equation

$\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$. The ratio is **1 : 1**, so $n(\text{H}_2) = n(\text{Mg})$.

Question 2 Amount of hydrogen

$n = 0.0250 / 24.305 = \mathbf{1.03 \times 10^{-3} \text{ mol}}$.

Question 3 Pressure of hydrogen

$P(\text{H}_2) = 100.80 - 2.49 = \mathbf{98.31 \text{ kPa}}$.

Question 4 Calculate R

$V = 0.0256 \text{ L}$. $R = 98.31 \times 0.0256 / (1.0286 \times 10^{-3} \times 294.15) = 2.5167 / 0.30256 = \mathbf{8.32 \text{ L}\cdot\text{kPa}/(\text{mol}\cdot\text{K})}$.

Question 5 Mean value

Mean = $(8.32 + 8.35 + 8.24) / 3 = \mathbf{8.30}$. Difference = $(8.314 - 8.30) / 8.314 \times 100 = \mathbf{0.2 \text{ percent}}$.

Question 6 Graph

A straight line through the origin, because $V = (RT/(P \cdot M)) \times \text{mass}$. Gradient = about 1.02 mL/mg, so **$RT/(P \cdot M)$** can be used to find R.

Question 7 Sources of error

Gas dissolving in water, or hydrogen lost before the bung fits, makes V too small and R too small. Reading the volume with unequal water levels changes the pressure inside. **Each of these changes R in a known direction.**

Question 8 Improvement

Use a gas syringe so no water vapour or dissolving occurs, and a larger Mg mass so the volume is larger; the percentage uncertainty in V and mass then falls. **This improves precision.**