Question 26 (4 marks)

A gas is produced when 10.0 g of zinc is placed in 0.50 L of 0.20 mol L\(^{-1}\) nitric acid.

Calculate the volume of gas produced at 25°C and 100 kPa. Include a balanced chemical equation in your answer.

\[
\text{Zn(s)} + 2\text{HNO}_3(aq) \rightarrow \text{H}_2(g) + \text{Zn(NO}_3)_2(aq)
\]

\[
n(\text{Zn}) = 10.0 \div 65.41 = 0.1528818324 \text{ mol}
\]

\[
n(\text{H}^+) = 0.1528818324 \times (2 + 6.02) \text{ mol} (\times 24.79)
\]

\[
= 3.789940376
\]

\[
n(\text{HNO}_3) = 0.20 \div 2 = 0.1 \text{ mol}\times 2 (2\text{HNO}_3)
\]

\[
n(\text{H}_2) =
\]

\[
n(\text{HNO}_3 \text{ used}) = 0.3057636448
\]

\[
\therefore n(\text{H}_2) = 0.3057636448 \div 2
\]

\[
= 0.1528818324 \times 24.79
\]

\[
= 3.789940376
\]

\[
= 3.79 \text{ L (3 sig fig)}
\]