

# Stoichiometry of gases

NAME: \_\_\_\_\_

# Solutions

1. What volume of oxygen (O<sub>2</sub>) and hydrogen (H<sub>2</sub>) gas is obtained during the decomposition of one mole of water at STP?

$$\begin{array}{c}
 \underline{2\text{H}_2\text{O}_{(l)}} \rightarrow \underline{2\text{H}_2\text{(g)}} + \text{O}_2\text{(g)} \\
 \begin{array}{ccc}
 2\text{mole} & \times & 2\text{mole} \\
 1\text{mole} & & x
 \end{array} \\
 \hline
 x = 1\text{mole of H}_2\text{ gas}
 \end{array}$$

$T = 273$   
 $P = 101.3$   
 $n = 1$

$$\begin{array}{l}
 PV = nRT \\
 V = \frac{nRT}{P} \\
 V = \frac{(1)(8.31)(273)}{101.3} \\
 \hline
 V = 22.4\text{L of H}_2\text{ gas}
 \end{array}$$

Answer: \_\_\_\_\_

1. What volume of oxygen (O<sub>2</sub>) and hydrogen (H<sub>2</sub>) gas is obtained during the decomposition of one mole of water at STP?

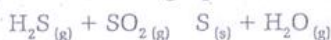
$$\begin{array}{c}
 \underline{2\text{H}_2\text{O}_{(l)}} \rightarrow \underline{2\text{H}_2\text{(g)}} + \underline{\text{O}_2\text{(g)}} \\
 \begin{array}{ccc}
 2\text{mole} & \times & 1\text{mole} \\
 1\text{mole} & & y
 \end{array} \\
 \hline
 y = 0.5\text{mole O}_2\text{ gas}
 \end{array}$$

$T = 273$   
 $P = 101.3$   
 $n = 0.5$

$$\begin{array}{l}
 PV = nRT \\
 V = \frac{nRT}{P} \\
 V = \frac{0.5(8.31)(273)}{101.3} \\
 \hline
 V = 11.2\text{L of O}_2\text{ gas}
 \end{array}$$

Answer: \_\_\_\_\_

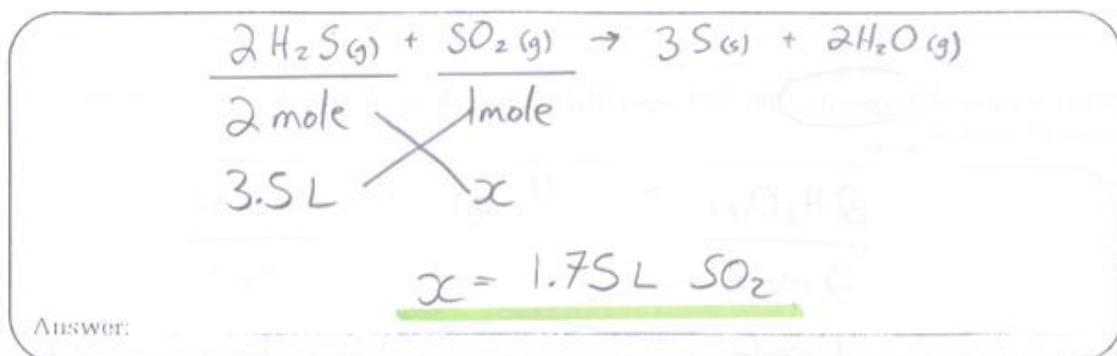
2. Hydrogen sulphide (H<sub>2</sub>S) is a gas that reacts spontaneously with sulphur dioxide (SO<sub>2</sub>) to produce sulphur (S) and water according to the following equation:



- a) Balance the equation.

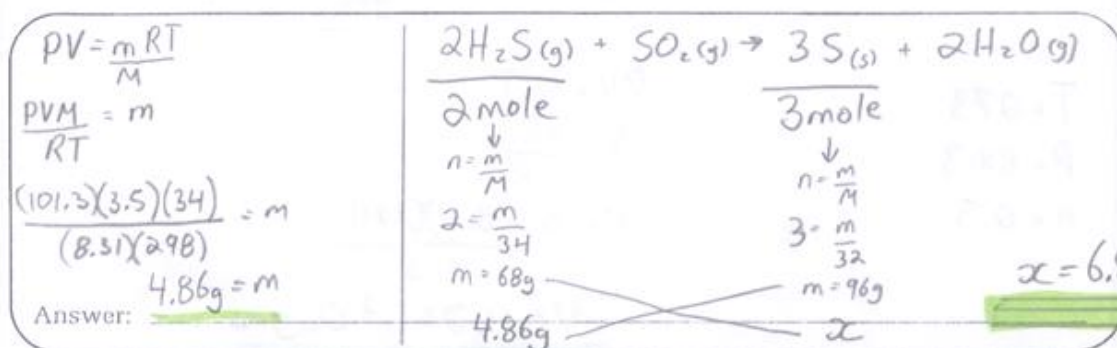


- b) At SATP, what volume of sulphur dioxide must react with 3.5 L of hydrogen sulphide to make all of the hydrogen sulphide disappear?

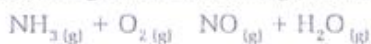


- c) What mass of sulphur is obtained?

$P = 101.3$   
 $T = 298$   
 $V = 3.5$   
 $M_{\text{H}_2\text{S}} = 34$   
 $m = ?$



3. The industrial manufacture of nitric acid ( $\text{HNO}_3$ ) from nitrogen monoxide (NO) is called the Ostwald process and occurs according to the following reaction:



- a) Balance the equation.



- b) If this reaction requires the presence of a catalyst and a temperature of  $850^\circ\text{C}$  under a pressure of 101.3 kPa, how many moles of oxygen ( $\text{O}_2$ ) will be needed to produce 475 L of nitrogen monoxide (NO)?

