

$$\textcircled{2} \quad \frac{42.86 \text{ mol}}{6.022 \times 10^{23} \text{ atom/mol}} = 2.58 \times 10^{25} \text{ atoms}$$

\textcircled{3} Because they have different MW (g/mol) \rightarrow 1 mol of CO₂ and 1 mol of CO are the same number of molecules, but CO₂ has more mass per molecule than CO because it has an extra atom.

$$\textcircled{4} \quad \frac{1.86 \times 10^{20} \text{ CO}_2}{6.022 \times 10^{23} \text{ mol}} = 0.0136 \text{ g CO}_2$$

$$\textcircled{5} \quad \frac{90.1853 \text{ g O}}{16 \text{ g/mol}} \times \frac{1 \text{ mol Na MnO}_4}{4 \text{ mol O}} \times \frac{141.94 \text{ g/mol}}{1 \text{ mol S}} = 200 \text{ g Na}_2\text{MnO}_4$$

$$\textcircled{6} \quad \text{C: } \frac{74.03 \text{ mol}}{12.01 \text{ g}} = 6.16 \text{ mol C} \div 0.616 = 10$$

$$\text{H: } \frac{7.471 \text{ mol}}{1.01 \text{ g}} = 7.397 \text{ mol H} \div 0.616 = 12$$



$$\text{N: } \frac{8.636 \text{ mol}}{14.01 \text{ g}} = 0.616 \text{ mol N} \div 0.616 = 1$$

$$\text{E.F.W.} = 162.23$$

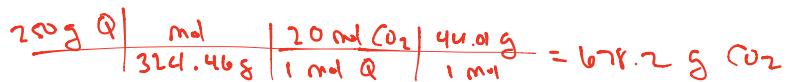
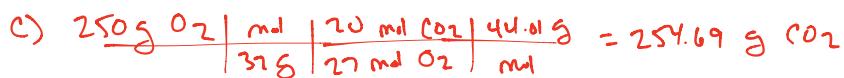
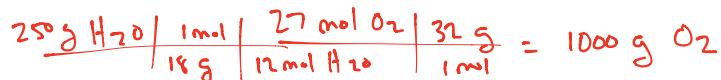
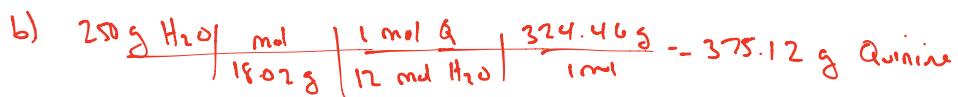
$$\text{O: } \frac{9.863 \text{ mol}}{16 \text{ g}} = 0.616 \text{ mol O} \div 0.616 = 1$$

$$\frac{324.46}{162.23} = 2$$

$$\text{M.F. } \text{C}_{10}\text{H}_{12}\text{N}_2\text{O}_2$$

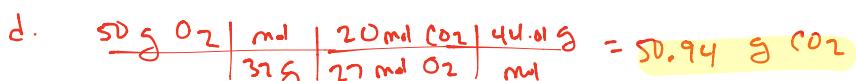


$$\text{a) } \frac{100 \text{ g}}{324.46 \text{ g/mol}} \times \frac{2 \text{ mol NO}_2}{1 \text{ mol O}_2} \times \frac{46.01 \text{ g}}{1 \text{ mol}} = 28.36 \text{ g NO}_2$$

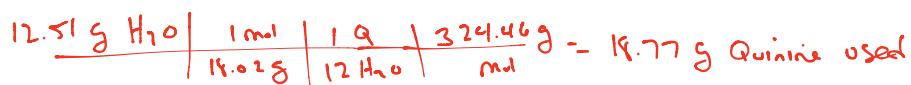
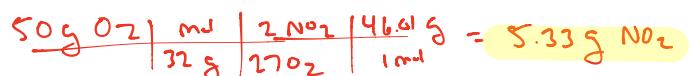
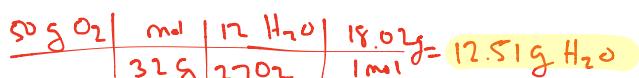


O₂ is Limiting $\rightarrow 305.63 \text{ g CO}_2$ = Theoretical Yield

$$\% \text{ Yield} = \frac{250 \text{ g}}{305.63 \text{ g}} \times 100 = 98.16 \%$$



O₂ = L.R. $\rightarrow \emptyset \text{ O}_2 \text{ left}$



$$25 - 18.77 = 6.23 \text{ g Quinine left}$$

$$8. \frac{1.8\text{ L}}{1\text{ L}} \left| \begin{array}{c} 3.25 \text{ mol NH}_4\text{Cl} \\ \hline \end{array} \right. = 5.85 \text{ mol NH}_4\text{Cl} \left| \begin{array}{c} 53.5 \text{ g} \\ \hline \text{mol} \end{array} \right. = 312.98 \text{ g NH}_4\text{Cl}$$

Measure out 312.98 g of NH₄Cl. Add water to a final volume of 1.8 L

$$9. \frac{154 \text{ mmol K}_3\text{PO}_4}{1\text{ L}} \left| \begin{array}{c} 3 \text{ mmol K}^+ \\ \hline 1 \text{ mmol K}_3\text{PO}_4 \end{array} \right. = 462 \text{ mmol K}^+ \left| \begin{array}{c} \\ \hline 1\text{ L} \end{array} \right. = 462 \text{ mM} \text{ or } 0.462 \text{ M}$$

$$10. \frac{550 \text{ mL}}{1\text{ mL}} \left| \begin{array}{c} 10^{-3}\text{ L} \\ \hline \end{array} \right| \left| \begin{array}{c} 1.5 \text{ mol NaCl} \\ \hline 1\text{ L} \end{array} \right. = 0.925 \text{ mol NaCl}$$

$$\text{new volume is } 550\text{ mL} + 354\text{ mL} = 904 \text{ mL} \left| \begin{array}{c} 10^{-3}\text{ L} \\ \hline 1\text{ mL} \end{array} \right. = 0.904 \text{ L}$$

$$\frac{0.925 \text{ mol NaCl}}{0.904 \text{ L}} = 0.913 \text{ M}$$



$$\text{FeCl}_2: \frac{900 \text{ mL}}{1\text{ mL}} \left| \begin{array}{c} 10^{-3}\text{ L} \\ \hline \end{array} \right| \left| \begin{array}{c} 0.25 \text{ mol FeCl}_2 \\ \hline 1\text{ L} \end{array} \right| \left| \begin{array}{c} 1 \text{ mol Fe(OH)}_2 \\ \hline 1 \text{ mol FeCl}_2 \end{array} \right. = 0.225 \text{ mol Fe(OH)}_2$$

$$\text{NaOH: } \frac{350 \text{ mL}}{1\text{ mL}} \left| \begin{array}{c} 10^{-3}\text{ L} \\ \hline \end{array} \right| \left| \begin{array}{c} 302 \text{ mmol NaOH} \\ \hline 1\text{ L} \end{array} \right| \left| \begin{array}{c} 1 \text{ mmol Fe(OH)}_2 \\ \hline 2 \text{ mmol NaOH} \end{array} \right| \left| \begin{array}{c} 10^{-3} \text{ mol} \\ \hline 1 \text{ mmol} \end{array} \right. = 0.05285 \text{ mol Fe(OH)}_2$$

$$\text{NaOH = limiting} \quad \frac{0.05285 \text{ mol Fe(OH)}_2}{1\text{ mol}} \left| \begin{array}{c} 89.87 \text{ g} \\ \hline \text{mol} \end{array} \right. = 4.75 \text{ g Fe(OH)}_2$$

b. Na⁺ is a spectator ion, so only need to consider dilution

$$\frac{0.35 \text{ L}}{1\text{ L}} \left| \begin{array}{c} 302 \text{ mmol NaOH} \\ \hline \end{array} \right| \left| \begin{array}{c} 1 \text{ mmol Na}^+ \\ \hline 1 \text{ mmol NaOH} \end{array} \right. = 105.7 \text{ mmol Na}^+$$

$$\text{New V} = 0.35\text{ L} + 0.9\text{ L} = 1.25 \text{ L} \quad \frac{105.7 \text{ mmol Na}^+}{1.25 \text{ L}} = 84.56 \text{ mM}$$