Stoichiometry

1.) In the reaction $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$
a.) 6 mol of C_2H_6 requires 21 mol of O_2
b.) 12 mol of C_2H_6 produces 36 mol of H_2O
c.) 18 mol of CO_2 requires 31.5 mol of O_2
d.) 13 mol of C_2H_6 produces 26 mol of CO_2

2.) In the reaction $Fe + H_2O \rightarrow Fe_3O_4 + H_2$
a.) 12 mol of Fe produces 4 mol of Fe_3O_4
b.) 16 mol of H_2 requires 12 mol of Fe
c.) 40 mol of Fe_3O_4 produces 160 mol of H_2
d.) 14.5 mol of Fe requires 19.3 mol of H_2O

3.) For the reaction $H_2 + O_2 \rightarrow H_2O$
9.6 mol of O_2 produces 19.2 mol of H_2O

4.) For the reaction $I_2 + F_2 \rightarrow IF_5 + I_4F_2$
a.) 5.40 mol of F_2 produces 0.3176 mol of I_4F_2
b.) 4.50 mol of IF_5 requires 7.65 mol of F_2
c.) 7.60 mol of F_2 requires 2.68 mol of I_2

5.) For the decomposition of H_2O_2
Total moles = 0.125 mol
From the ratio (2 $H_2O_2 \rightarrow$ 2 H_2O + 1 O_2), 1/5 of the total is O_2
0.125 mol × (1/5) = 0.025 mol of O_2 produced

More Stoichoimetry

1a.) 60.0 g NO
1b.) 86.5 g H_2O
1c.) 53.8 L NH_3
1d.) 11.2 L NH_3

2a.) 304.0 g CO_2
2b.) 142 g O_2
2c.) 58 g C_5H_{12}
2d.) 57.0 L O_2
2e.) 76.8 L O_2
2f.) 102 g H_2O

3a.) 135.5 L O_2
3b.) 1.49×10^{16} molecules CO_2

3c.) 100 molecules H_2O
3d.) 5.02×10^{-4} mL O_2

Molarity

1.)
Balanced equation: 2 Al (s) + 2 NaOH (aq) + 2 H_2O (l) → 2 $NaAlO_2$ (aq) + 3 H_2 (g)
Answer: 0.496 L NaOH solution

2.)
Balanced equation: HCl + NaOH → NaCl + H_2O
Answer: 0.0318 L HCl

3a.)
Answer: 0.00456 mol Hg^{2+}

3b.)
Answer: 0.0310 g $HgCl_2$

4a.)
Balanced equation: $Ca(OH)_2$ + 2 HCl → $CaCl_2$ + 2 H_2O
Answer: 1.83 M $Ca(OH)_2$

4b.)
Answer: 33.9 g $Ca(OH)_2$ in 250.0 mL

5a.)
Answer: 0.0200 L MnO_4^- solution

5b.)
Answer: 0.0556 L O_2 (g) at STP

6a.)
Balanced equation: 2 NaOH + H_3PO_4 → Na_2HPO_4 + 2 H_2O
Answer: 18.7 M H_3PO_4

6b.)
Answer: 1831 g/L (density of H_3PO_4)

7a.)
Answer: 0.528 M Fe^{2+}

7b.)
Answer: 0.737 g Fe

8a.)
Answer: 0.155 M NaOH

8b.)
Answer: 0.0868 L NH_3 at STP

9a.)
Answer: 0.00135 mol $Ba(OH)_2$

9b.)
Answer: 0.00120 mol $Ba(OH)_2$ (unreacted)

9c.)
Answer: 0.000149 mol $Ba(OH)_2$ (reacted)

9d.)
Answer: 0.000149 mol CO_2

9e.)
Answer: 0.00345 L CO_2 at STP

Diluations

1.) If $20.0\ mL$ of $0.75\ M$ HBr is diluted to a total volume of $90.0\ mL$, what is the molar concentration of the HBr in the resulting solution?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.75)(0.020)}{(0.090)}$ $C_{dil} = 0.17\ M$

2.) What is the molar concentration of the KOH solution resulting from mixing $55\ mL$ of $0.15\ M$ KOH and $75\ mL$ of $0.25\ M$ KOH?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}} + \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.15)(0.055)}{(0.055+0.075)} + \frac{(0.25)(0.075)}{(0.055+0.075)}$ $C_{dil} = 0.21\ M$

3.) If 1 drop ($0.050\ mL$) of $0.20\ M$ NaBr is added to $100.0\ mL$ of water, what is the molarity of the NaBr in the resulting solution?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(0.20)(0.000050)}{(0.100+0.00005)}$ $C_{dil} = 1.0 \times 10^{-4}\ M$

4.) What is the molar concentration of the HNO_3 solution resulting from mixing $5.0\ mL$ of $3.5\ M$ HNO_3 and $95\ mL$ of $0.20\ M$ HNO_3?

Answer - $C_{dil} = \frac{C_{conc} \times V_{conc}}{V_{dil}} + \frac{C_{conc} \times V_{conc}}{V_{dil}}$ $C_{dil} = \frac{(3.5)(0.005)}{(0.095+0.005)} + \frac{(0.20)(0.095)}{(0.095+0.005)}$ $C_{dil} = 0.37\ M$

5.) Concentrated HNO_3 is $15.4\ M$. How would you prepare $2.50\ L$ of $0.375\ M$ HNO_3?

Answer - $V_{conc} = \frac{C_{dil} \times V_{dil}}{C_{conc}}$ $V_{conc} = \frac{0.375 \times 2.50}{15.4}$ $V_{conc} = 0.0609\ L$ Mix $60.9\ mL$ with water to make $2.5\ L$.

Limiting Reagent

1a) 22.0 g CS_2
1b) 2.3 g SO2 left over

2a) 26.8 g NO
2b) 1.9 g Cu left over

3a) 8.05 g P_4
3b) 3.08 g SiO_2 and 1.21 g Ca3(PO4)2 left over

4a) 12.3 g Br_2
4b) 2.3 g K2Cr2O7 and 7.1 g H_2SO_4 left over

5. 24.3 L CO_2 at STP

6. NaOH is excess

7. 0.279 g $BaBr_2$

Percentage Yield

1.) 93.4%
2a.) 7.22 SiF4
b.) 8.03 SiO2
c.) 34.3%
3.) 130. CuO
4.) 88.37%