1. $2S(s) + 3O_2(g) ==> 2SO_3(g)$

$$9 \text{ mol } O_2 \times \frac{2 \text{ mol S}}{3 \text{ mol } O_2} = 6 \text{ mol S}$$

2. $4FeS(s) + 7O_2 ==> 2Fe_2O_3(s) + 4SO_2(g)$
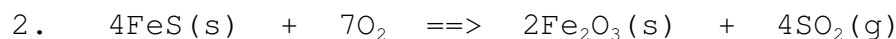
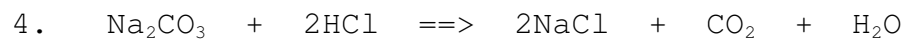$$7.81 \text{ g } O_2 \times \frac{1 \text{ mol } O_2}{32.00 \text{ g } O_2} \times \frac{4 \text{ mol FeS}}{7 \text{ mol } O_2} \times \frac{87.92 \text{ g FeS}}{1 \text{ mol FeS}} = 12.3 \text{ g FeS}$$

$$6.79 \text{ mol FeS} \times \frac{7 \text{ mol } O_2}{4 \text{ mol FeS}} = 11.9 \text{ mol } O_2$$

3. $CH_4(g) + 2O_2(g) ==> CO_2(g) + 2H_2O(l)$
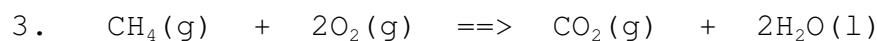
$$6.4 \text{ g } CH_4 \times \frac{1 \text{ mol } CH_4}{16.05 \text{ g } CH_4} \times \frac{2 \text{ mol } O_2}{1 \text{ mol } CH_4} \times \frac{32.00 \text{ g } O_2}{1 \text{ mol } O_2} = 25.5 \text{ g } O_2$$

$$6.4 \text{ g } CH_4 \times \frac{1 \text{ mol } CH_4}{16.05 \text{ g } CH_4} \times \frac{1 \text{ mol } CO_2}{1 \text{ mol } CH_4} \times \frac{44.01 \text{ g } CO_2}{1 \text{ mol } CO_2} = 17.5 \text{ g } CO_2$$

4. $Na_2CO_3 + 2HCl ==> 2NaCl + CO_2 + H_2O$

$$286 \text{ g } CO_2 \times \frac{1 \text{ mol } CO_2}{44.01 \text{ g } CO_2} \times \frac{1 \text{ mol } Na_2CO_3}{1 \text{ mol } CO_2} \times \frac{105.99 \text{ g } Na_2CO_3}{1 \text{ mol } Na_2CO_3} = 689 \text{ g } Na_2CO_3$$

$$286 \text{ g } CO_2 \times \frac{1 \text{ mol } CO_2}{44.01 \text{ g } CO_2} \times \frac{2 \text{ mol HCl}}{1 \text{ mol } CO_2} \times \frac{36.46 \text{ g HCl}}{1 \text{ mol HCl}} = 474 \text{ g HCl}$$

5. $2NaOH(aq) + H_2SO_4(aq) ==> Na_2SO_4(aq) + 2H_2O(l)$
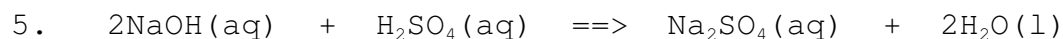
$$8.61 \text{ mol Na}_2SO_4 \times \frac{2 \text{ mol NaOH}}{1 \text{ mol Na}_2SO_4} = 17.22 \text{ mol NaOH}$$

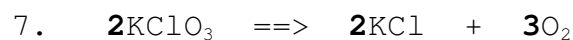$$4.77 \text{ mol Na}_2SO_4 \times \frac{1 \text{ mol H}_2SO_4}{1 \text{ mol Na}_2SO_4} \times \frac{98.09 \text{ g H}_2SO_4}{1 \text{ mol H}_2SO_4} = 468 \text{ g H}_2SO_4$$

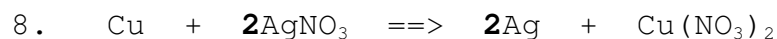6. $Zn + \mathbf{2}HCl ==> ZnCl_2 + H_2$

$$20.0 \text{ g Zn} \times \frac{1 \text{ mol Zn}}{65.41 \text{ g Zn}} \times \frac{1 \text{ mol ZnCl}_2}{1 \text{ mol Zn}} \times \frac{136.31 \text{ g ZnCl}_2}{1 \text{ mol ZnCl}_2} = 41.7 \text{ g ZnCl}_2$$

$$20.0 \text{ g Zn} \times \frac{1 \text{ mol Zn}}{65.41 \text{ g Zn}} \times \frac{1 \text{ mol H}_2}{1 \text{ mol Zn}} \times \frac{2.02 \text{ g H}_2}{1 \text{ mol H}_2} = 0.618 \text{ g H}_2$$
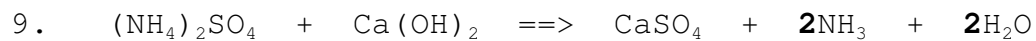
$$20.0 \text{ g Zn} \times \frac{1 \text{ mol Zn}}{65.41 \text{ g Zn}} \times \frac{2 \text{ mol HCl}}{1 \text{ mol Zn}} \times \frac{36.46 \text{ g HCl}}{1 \text{ mol HCl}} = 22.3 \text{ g HCl}$$
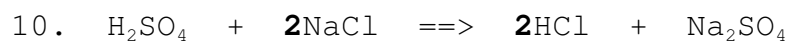
7. $\mathbf{2}KClO_3 ==> \mathbf{2}KCl + \mathbf{3}O_2$

$$5.0 \text{ g KClO}_3 \quad \frac{1 \text{ mol KClO}_3}{122.55 \text{ g KClO}_3} \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} \times \frac{32.00 \text{ g O}_2}{1 \text{ mol O}_2} = 1.96 \text{ g O}_2$$

8. $Cu + \mathbf{2}AgNO_3 ==> \mathbf{2}Ag + Cu(NO_3)_2$

$$4.0 \text{ g AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{169.88 \text{ g AgNO}_3} \times \frac{1 \text{ mol Cu}}{2 \text{ mol AgNO}_3} \times \frac{63.55 \text{ g Cu}}{1 \text{ mol Cu}} = 0.748 \text{ g Cu}$$

9. $(NH_4)_2SO_4$ + $Ca(OH)_2$ ==> $CaSO_4$ + **2**NH_3 + **2**H_2O

$$20.0 \text{ g Ca(OH)}_2 \text{ x } \frac{1 \text{ mol Ca(OH)}_2}{74.10 \text{ g Ca(OH)}_2} \text{ x } \frac{2 \text{ mol NH}_3}{1 \text{ mol Ca(OH)}_2} \text{ x } \frac{17.04 \text{ g NH}_3}{1 \text{ mol NH}_3} = 9.20 \text{ g NH}_3$$

10. H_2SO_4 + **2**NaCl ==> **2**HCl + Na_2SO_4

$$30.0 \text{ g NaCl x } \frac{1 \text{ mol NaCl}}{58.44 \text{ g NaCl}} \text{ x } \frac{2 \text{ mol HCl}}{2 \text{ mol NaCl}} \text{ x } \frac{36.46 \text{ g HCl}}{1 \text{ mol HCl}} = 18.7 \text{ g HCl}$$