6. (a) mass of NO = $2.00 \text{ mol NH}_3 \times \dfrac{4 \text{ mol NO}}{4 \text{ mol NH}_3} \times \dfrac{30.0 \text{ g NO}}{1 \text{ mol NO}} =$ **60.0 g** NO

(b) mass of H_2O = $4.00 \text{ mol O}_2 \times \dfrac{6 \text{ mol H}_2O}{5 \text{ mol O}_2} \times \dfrac{18.0 \text{ g H}_2O}{1 \text{ mol H}_2O} =$ **86.4 g** H_2O

(c) volume of NH_3 = $3.00 \text{ mol O}_2 \times \dfrac{4 \text{ mol NH}_3}{5 \text{ mol O}_2} \times \dfrac{22.4 \text{ L NH}_3}{1 \text{ mol NH}_3} =$ **53.8 L** NH_3

(d) volume of NH_3 = $0.750 \text{ mol H}_2O \times \dfrac{4 \text{ mol NH}_3}{6 \text{ mol H}_2O} \times \dfrac{22.4 \text{ L NH}_3}{1 \text{ mol NH}_3} =$ **11.2 L** NH_3

7. (a) mass of CO_2 = $100.0 \text{ g C}_5H_{12} \times \dfrac{1 \text{ mol C}_5H_{12}}{72.0 \text{ g C}_5H_{12}} \times \dfrac{5 \text{ mol CO}_2}{1 \text{ mol C}_5H_{12}} \times \dfrac{44.0 \text{ g CO}_2}{1 \text{ mol CO}_2} =$ **306 g** CO_2

(b) mass of O_2 = $60.0 \text{ g H}_2O \times \dfrac{1 \text{ mol H}_2O}{18.0 \text{ g H}_2O} \times \dfrac{8 \text{ mol O}_2}{6 \text{ mol H}_2O} \times \dfrac{32.0 \text{ g O}_2}{1 \text{ mol O}_2} =$ **142 g** O_2

(c) mass of C_5H_{12} = $90.0 \text{ L CO}_2 \times \dfrac{1 \text{ mol CO}_2}{22.4 \text{ L CO}_2} \times \dfrac{1 \text{ mol C}_5H_{12}}{5 \text{ mol CO}_2} \times \dfrac{72.0 \text{ g C}_5H_{12}}{1 \text{ mol C}_5H_{12}} =$ **57.9 g** C_5H_{12}

(d) volume of O_2 = $70.0 \text{ g CO}_2 \times \dfrac{1 \text{ mol CO}_2}{44.0 \text{ g CO}_2} \times \dfrac{8 \text{ mol O}_2}{5 \text{ mol CO}_2} \times \dfrac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} =$ **57.0 L** O_2

(e) volume of O_2 = $48.0 \text{ L CO}_2 \times \dfrac{1 \text{ mol CO}_2}{22.4 \text{ L CO}_2} \times \dfrac{8 \text{ mol O}_2}{5 \text{ mol CO}_2} \times \dfrac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} =$ **76.8 L** O_2

(f) mass of H_2O = $106 \text{ L CO}_2 \times \dfrac{1 \text{ mol CO}_2}{22.4 \text{ L CO}_2} \times \dfrac{6 \text{ mol H}_2O}{5 \text{ mol CO}_2} \times \dfrac{18.0 \text{ g H}_2O}{1 \text{ mol H}_2O} =$ **102 g** H_2O

8. (a) volume of O_2 = $100.0 \text{ g PbO} \times \dfrac{1 \text{ mol PbO}}{223.2 \text{ g PbO}} \times \dfrac{27 \text{ mol O}_2}{2 \text{ mol PbO}} \times \dfrac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} =$ **135 L** O_2

(b) # of molecules of CO_2 = $1.00 \times 10^{-6} \text{ g Pb(C}_2H_5)_4 \times \dfrac{1 \text{ mol Pb(C}_2H_5)_4}{323.2 \text{ g Pb(C}_2H_5)_4} \times \dfrac{16 \text{ mol CO}_2}{2 \text{ mol Pb(C}_2H_5)_4}$

$\times \dfrac{6.02 \times 10^{23} \text{ molecules CO}_2}{1 \text{ mol CO}_2} =$ **1.49 x 10^{16} molecules** CO_2

(c) # of molecules of H_2O = $135 \text{ molecules O}_2 \times \dfrac{20 \text{ molecules H}_2O}{27 \text{ molecules O}_2} =$ **100 molecules** H_2O

(d) volume of O_2 = $1.00 \times 10^{15} \text{ molec Pb(C}_2H_5)_4 \times \dfrac{1 \text{ mol Pb(C}_2H_5)_4}{6.02 \times 10^{23} \text{ molec Pb(C}_2H_5)_4} \times \dfrac{27 \text{ mol O}_2}{2 \text{ mol Pb(C}_2H_5)_4}$

$\times \dfrac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} \times \dfrac{1 \text{ mL}}{10^{-3} \text{ L}} =$ **5.02 x 10^{-4} mL** O_2

9. (a) mass of $H_2O = 0.150$ g $CH_3NO_2 \times \dfrac{1 \text{ mol } CH_3NO_2}{61.0 \text{ g } CH_3NO_2} \times \dfrac{6 \text{ mol } H_2O}{4 \text{ mol } CH_3NO_2} \times \dfrac{18.0 \text{ g } H_2O}{1 \text{ mol } H_2O} = 0.0664$ g H_2O

(b) First, note that 4 mol of CH_3NO_2 produce 4 mol $CO_2(g)$ and 2 mol $N_2(g)$; that is, 6 mol of gas.

   volume of gas $= 0.316$ g $CH_3NO_2 \times \dfrac{1 \text{ mol } CH_3NO_2}{61.0 \text{ g } CH_3NO_2} \times \dfrac{6 \text{ mol gas}}{4 \text{ mol } CH_3NO_2} \times \dfrac{22.4 \text{ L gas}}{1 \text{ mol gas}} = 0.174$ L gas

(c) volume of $O_2 = 0.250$ g $CO_2 \times \dfrac{1 \text{ mol } CO_2}{44.0 \text{ g } CO_2} \times \dfrac{3 \text{ mol } O_2}{4 \text{ mol } CO_2} \times \dfrac{22.4 \text{ L } O_2}{1 \text{ mol } O_2} = 0.0955$ L O_2

(d) mass of $H_2O = 0.410$ g $CO_2 \times \dfrac{1 \text{ mol } CO_2}{44.0 \text{ g } CO_2} \times \dfrac{6 \text{ mol } H_2O}{4 \text{ mol } CO_2} \times \dfrac{18.0 \text{ g } H_2O}{1 \text{ mol } H_2O} = 0.252$ g H_2O

10. mass of $SiCl_4 = 1.00$ g Si $\times \dfrac{1 \text{ mol Si}}{28.1 \text{ g Si}} \times \dfrac{1 \text{ mol } SiCl_4}{1 \text{ mol Si}} \times \dfrac{170.1 \text{ g } SiCl_4}{1 \text{ mol } SiCl_4} = 6.05$ g $SiCl_4$

   mass of $H_2 = 1.00$ g Si $\times \dfrac{1 \text{ mol Si}}{28.1 \text{ g Si}} \times \dfrac{2 \text{ mol } H_2}{1 \text{ mol Si}} \times \dfrac{2.0 \text{ g } H_2}{1 \text{ mol } H_2} = 0.14$ g H_2

11. volume of $NH_3 = 1.25 \times 10^4$ kg $N_2H_4 \times \dfrac{10^3 \text{ g } N_2H_4}{1 \text{ kg } N_2H_4} \times \dfrac{1 \text{ mol } N_2H_4}{32.0 \text{ g } N_2H_4} \times \dfrac{2 \text{ mol } NH_3}{1 \text{ mol } N_2H_4} \times \dfrac{22.4 \text{ L } NH_3}{1 \text{ mol } NH_3}$

   $= 1.75 \times 10^7$ L NH_3

12. mass of $H_2SO_4 = 25.0$ mL $\times 1.84 \dfrac{g}{mL} = 46.0$ g H_2SO_4

   mass of $P_4O_{10} = 46.0$ g $H_2SO_4 \times \dfrac{1 \text{ mol } H_2SO_4}{98.1 \text{ g } H_2SO_4} \times \dfrac{1 \text{ mol } P_4O_{10}}{6 \text{ mol } H_2SO_4} \times \dfrac{284.0 \text{ g } P_4O_{10}}{1 \text{ mol } P_4O_{10}} = 22.2$ g P_4O_{10}

   volume of $SO_3 = 46.0$ g $H_2SO_4 \times \dfrac{1 \text{ mol } H_2SO_4}{98.1 \text{ g } H_2SO_4} \times \dfrac{6 \text{ mol } SO_3}{6 \text{ mol } H_2SO_4} \times \dfrac{22.4 \text{ L } SO_3}{1 \text{ mol } SO_3} = 10.5$ L SO_3