CHEM 1050 Homework
Exam #3 Assignment-Solutions

Alan D. Earhart

7.1 1 mole is equivalent to 6.0221×10^{23} "things"

7.2 6.0221×10^{23}

7.4 a. $\left(\frac{4.5 \text{ mol Li}}{1}\right)\left(\frac{6.0221\times10^{23} \text{ atoms}}{1 \text{ mol}}\right) = 2.7\times10^{24} \text{ atoms Li}$

b. $\left(\frac{0.0180 \text{ mol } CO_2}{1}\right)\left(\frac{6.0221\times10^{23} \text{ molecules}}{1 \text{ mol}}\right) = 1.08\times10^{22} \text{ molecules } CO_2$

c. $\left(\frac{7.8\times10^{21} \text{ atoms Cu}}{1}\right)\left(\frac{1 \text{ mol}}{6.0221\times10^{23} \text{ atoms}}\right) = 0.013 \text{ mol Cu}$

d. $\left(\frac{3.75\times10^{23} \text{ molecules } C_2H_6}{1}\right)\left(\frac{1 \text{ mol}}{6.0221\times10^{23} \text{ molecules}}\right) = 0.623 \text{ mol } C_2H_6$

7.7 a. $\left(\frac{1.0 \text{ mol quinine}}{1}\right)\left(\frac{24 \text{ mol H}}{1 \text{ mol quinine}}\right) = 24 \text{ mol hydrogen}$

b. $\left(\frac{5.0 \text{ mol quinine}}{1}\right)\left(\frac{20 \text{ mol carbon}}{1 \text{ mol quinine}}\right) = 1.0\text{x}10^{2} \text{ mol carbon}$

c. $\left(\frac{0.020 \text{ mol quinine}}{1}\right)\left(\frac{2 \text{ mol nitrogen}}{1 \text{ mol quinine}}\right) = 0.040 \text{ mol nitrogen}$

7.9 a. 188.1 g/mol b. 159.6 g/mol c. 329.0 g/mol
d. 342.3 g/mol e. 58.3 g/mol

7.10 a. 151.9 g/mol b. 102.0 g/mol c. 183.1 g/mol
d. 60.0 g/mol e. 96.0 g/mol

7.14 a. $\left(\frac{1.50 \text{ mol K}}{1}\right)\left(\frac{39.1 \text{ g K}}{1 \text{ mol K}}\right) = 58.7 \text{ g K}$

b. $\left(\frac{2.5 \text{ mol C}}{1}\right)\left(\frac{12.0 \text{ g C}}{1 \text{ mol C}}\right) = 30. \text{ g C}$

c. $\left(\frac{0.25 \text{ mol P}}{1}\right)\left(\frac{31.0 \text{ g P}}{1 \text{ mol P}}\right) = 7.8 \text{ g P}$

d. $\left(\frac{12.5 \text{ mol He}}{1}\right)\left(\frac{4.0 \text{ g He}}{1 \text{ mol He}}\right) = 50. \text{ g He}$

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7.15 a. $\left(\frac{0.500\ \text{mol NaCl}}{1}\right)\left(\frac{58.5\ \text{g NaCl}}{1\ \text{mol NaCl}}\right)=29.3\ \text{g NaCl}$

b. $\left(\frac{1.75\ \text{mol Na}_2\text{O}}{1}\right)\left(\frac{62.0\ \text{g Na}_2\text{O}}{1\ \text{mol Na}_2\text{O}}\right)=109\ \text{g Na}_2\text{O}$

c. $\left(\frac{0.225\ \text{mol H}_2\text{O}}{1}\right)\left(\frac{18.0\ \text{g H}_2\text{O}}{1\ \text{mol H}_2\text{O}}\right)=4.05\ \text{g H}_2\text{O}$

d. $\left(\frac{4.42\ \text{mol CO}_2}{1}\right)\left(\frac{44.0\ \text{g CO}_2}{1\ \text{mol CO}_2}\right)=194\ \text{g CO}_2$

7.16 a. $\left(\frac{2.0\ \text{mol MgCl}_2}{1}\right)\left(\frac{95.3\ \text{g MgCl}_2}{1\ \text{mol MgCl}_2}\right)=190\ \text{g MgCl}_2$

b. $\left(\frac{3.5\ \text{mol C}_6\text{H}_6}{1}\right)\left(\frac{78.0\ \text{g C}_6\text{H}_6}{1\ \text{mol C}_6\text{H}_6}\right)=270\ \text{g C}_6\text{H}_6$

c. $\left(\frac{5.00\ \text{mol C}_2\text{H}_6\text{O}}{1}\right)\left(\frac{46.0\ \text{g C}_2\text{H}_6\text{O}}{1\ \text{mol C}_2\text{H}_6\text{O}}\right)=230\ \text{g C}_2\text{H}_6\text{O}$

d. $\left(\frac{0.488\ \text{mol C}_3\text{H}_6\text{O}_3}{1}\right)\left(\frac{90.0\ \text{g C}_3\text{H}_6\text{O}_3}{1\ \text{mol C}_3\text{H}_6\text{O}_3}\right)=43.9\ \text{g C}_3\text{H}_6\text{O}_3$

7.24 a. $\left(\frac{75\ \text{g C}}{1}\right)\left(\frac{1\ \text{mol C}}{12.0\ \text{g C}}\right)=6.3\ \text{mol C}$

b. $\left(\frac{0.25\ \text{mol C}_2\text{H}_6}{1}\right)\left(\frac{2\ \text{mol C}}{1\ \text{mol C}_2\text{H}_6}\right)=0.50\ \text{mol C}$

c. $\left(\frac{88\ \text{g CO}_2}{1}\right)\left(\frac{1\ \text{mol CO}_2}{44.0\ \text{g CO}_2}\right)\left(\frac{1\ \text{mol C}}{1\ \text{mol CO}_2}\right)=2.0\ \text{mol C}$

7.28 a. balanced b. balanced c. unbalanced d. unbalanced

7.29 a. $\text{N}_2(g)+\text{O}_2(g)\rightarrow 2\text{NO}(g)$

b. $2\text{HgO}(s)\rightarrow 2\text{Hg}(\ell)+\text{O}_2(g)$

c. $4\text{Fe}(s)+3\text{O}_2(g)\rightarrow 2\text{Fe}_2\text{O}_3(s)$

d. $2\text{Na}(s)+\text{Cl}_2(g)\rightarrow 2\text{NaCl}(s)$

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7.32 a. $Zn(s) + 2HNO_3(aq) \rightarrow Zn(NO_3)_2(aq) + H_2(g)$

b. $2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$

c. $K_2SO_4(aq) + BaCl_2(aq) \rightarrow 2KCl(aq) + BaSO_4(s)$

d. balanced

7.35 a. combination b. single replacement c. decomposition
d. double replacement e. combustion

7.49 a. $\left(\frac{2.0\text{ mol H}_2}{1}\right)\left(\frac{1\text{ mol O}_2}{2\text{ mol H}_2}\right) = 1.0\text{ mol O}_2$

b. $\left(\frac{5.0\text{ mol O}_2}{1}\right)\left(\frac{2\text{ mol H}_2}{1\text{ mol O}_2}\right) = 10.\text{ mol H}_2$

c. $\left(\frac{2.5\text{ mol O}_2}{1}\right)\left(\frac{2\text{ mol H}_2\text{O}}{1\text{ mol O}_2}\right) = 5.0\text{ mol H}_2\text{O}$

7.51 a. $\left(\frac{0.500\text{ mol SO}_2}{1}\right)\left(\frac{5\text{ mol C}}{2\text{ mol SO}_2}\right) = 1.25\text{ mol C}$

b. $\left(\frac{1.2\text{ mol C}}{1}\right)\left(\frac{4\text{ mol CO}}{5\text{ mol C}}\right) = 0.96\text{ mol CO}$

c. $\left(\frac{0.50\text{ mol CS}_2}{1}\right)\left(\frac{2\text{ mol SO}_2}{1\text{ mol CS}_2}\right) = 1.0\text{ mol C}$

d. $\left(\frac{2.5\text{ mol C}}{1}\right)\left(\frac{1\text{ mol CS}_2}{5\text{ mol C}}\right) = 0.50\text{ mol CS}_2$

7.58 a. $\left(\frac{75.0\text{ g CaCN}_2}{1}\right)\left(\frac{1\text{ mol CaCN}_2}{80.1\text{ g CaCN}_2}\right)\left(\frac{3\text{ mol H}_2\text{O}}{1\text{ mol CaCN}_2}\right)\left(\frac{18.0\text{ g H}_2\text{O}}{1\text{ mol H}_2\text{O}}\right) = 50.6\text{ g H}_2\text{O}$

b. $\left(\frac{5.24\text{ g CaCN}_2}{1}\right)\left(\frac{1\text{ mol CaCN}_2}{80.1\text{ g CaCN}_2}\right)\left(\frac{2\text{ mol NH}_3}{1\text{ mol CaCN}_2}\right)\left(\frac{17.0\text{ g NH}_3}{1\text{ mol NH}_3}\right) = 2.22\text{ g NH}_3$

c. $\left(\frac{155\text{ g H}_2\text{O}}{1}\right)\left(\frac{1\text{ mol H}_2\text{O}}{18.0\text{ g H}_2\text{O}}\right)\left(\frac{1\text{ mol CaCO}_3}{3\text{ mol H}_2\text{O}}\right)\left(\frac{100.1\text{ g CaCO}_3}{1\text{ mol CaCO}_3}\right) = 287\text{ g CaCO}_3$

7.62 a. The difference in energies between the products and the reactants

b. exothermic = heat is produced, endothermic=heat is absorbed

c. higher

d. see the second graph on page 240 for the shape and relative energies

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7.63 a. exothermic b. endothermic c. exothermic

7.109 When oxygen is mentioned in chemical reactions, assume it's O_2

a. In this section, I'll give you any needed chemical equations. The question in the book is balanced for one mole of acetylene as follows:

$$C_2H_2(g) + \frac{5}{2}O_2(g) \rightarrow H_2O(g) + 2CO_2(g) + 1300\,\text{kJ}$$

However, we discussed balancing equations using small whole numbers as follows:

$$2C_2H_2(g) + 5O_2(g) \rightarrow 2H_2O(g) + 4CO_2(g) + 2600\,\text{kJ}$$

Since this is for 2 moles of C_2H_2, I needed to double the energy produced.

b. exothermic

c. $\left(\frac{2.00\ \text{mol}\ O_2}{1}\right)\left(\frac{2\ \text{mol}\ H_2O}{5\ \text{mol}\ O_2}\right) = 0.800\ \text{mol}\ H_2O$

d. $\left(\frac{9.80\ \text{g}\ C_2H_2}{1}\right)\left(\frac{1\ \text{mol}\ C_2H_2}{26.0\ \text{g}\ C_2H_2}\right)\left(\frac{5\ \text{mol}\ O_2}{2\ \text{mol}\ C_2H_2}\right)\left(\frac{32.0\ \text{g}\ O_2}{1\ \text{mol}\ O_2}\right) = 30.2\ \text{mol}\ O_2$