*See pages 3-5 for worked out problems

Stoich Practice (mass only) Name: KEY

1. Given the following equation: $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$, show what the following molar ratios should be.

a. C_4H_{10} / O_2 2/13

b. O_2 / CO_2 13/8

c. O_2 / H_2O 13/10

d. C_4H_{10} / CO_2 2/8

e. C_4H_{10} / H_2O 2/10

2. Given the following equation: $2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$

How many moles of O_2 can be produced by letting 12.00 moles of $KClO_3$ react?

18 mol O_2

3. Given the following equation: $2\ K + Cl_2 \rightarrow 2\ KCl$

How many grams of KCl is produced: A) from 2.50 g of K and excess Cl_2. B) From 1.00 g of Cl_2 and excess K?

4.78 g KCl

2.10 g KCl

4. Given the following equation: $Na_2O + H_2O \rightarrow 2\ NaOH$

How many grams of NaOH is produced from 1.20×10^2 grams of Na_2O? How many grams of Na_2O are required to produce 1.60×10^2 grams of NaOH?

124 g Na_2O

154.84 g NaOH

5. Given the following equation: $8\ Fe + S_8 \rightarrow 8\ FeS$

What mass of iron is needed to react with 16.0 grams of sulfur? How many grams of FeS are produced?

28 g Fe

44 g FeS

6. Given the following equation: $2\ NaClO_3 \rightarrow 2\ NaCl + 3\ O_2$

12.00 moles of $NaClO_3$ will produce how many grams of O_2? How many grams of NaCl are produced when 80.0 grams of O_2 are produced?

↳ 576g O_2 ↳ 97.5 g NaCl

7. Given the following equation: $Cu + 2\ AgNO_3 \rightarrow Cu(NO_3)_2 + 2\ Ag$

How many moles of Cu are needed to react with 3.50 moles of $AgNO_3$? If 89.5 grams of Ag were produced, how many grams of Cu reacted?

↓ 1.75mol Cu ↓ 26.3 g Cu

8. Molten iron and carbon monoxide are produced in a blast furnace by the reaction of iron(III) oxide and coke (pure carbon). If 25.0 kilograms of pure Fe_2O_3 is used, how many kilograms of iron can be produced?

The reaction is: $Fe_2O_3 + 3\ C \rightarrow 2\ Fe + 3\ CO$

17.5 kg Fe

9. The average human requires 120.0 grams of glucose ($C_6H_{12}O_6$) per day. How many grams of CO_2 (in the photosynthesis reaction) are required for this amount of glucose?

The photosynthetic reaction is: $6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$

176g CO_2

10. Given the reaction: $4\ NH_3\ (g) + 5\ O_2\ (g) \rightarrow 4\ NO\ (g) + 6\ H_2O\ (l)$

When 1.20 mole of ammonia reacts, the total number of moles of products formed is:

1.2 mol NO
1.8 mol H_2O

1) $\underline{2}\ C_4H_{10} + \underline{13}O_2 \rightarrow \underline{8}\ CO_2 + \underline{10}\ H_2O$

coefficients determine mole ratio

a. $\frac{2\ mol\ C_4H_{10}}{13\ mol\ O_2}$ b. $\frac{13\ mol\ O_2}{8\ mol\ CO_2}$ c. $\frac{13\ mol\ O_2}{10\ mol\ H_2O}$

d. $\frac{2\ mol\ C_4H_{10}}{8\ mol\ CO_2}$ e. $\frac{2\ mol\ C_4H_{10}}{10\ mol\ H_2O}$

2) $2\ KClO_3 \rightarrow 2\ KCl + 3O_2$

1 step problem [mole A] → [mole B]

$$\frac{12\ mol\ KClO_3}{} \left| \frac{3\ mol\ O_2}{2\ mol\ KClO_3} \right. = \frac{36}{2} = 18\ mol\ O_2$$

(coefficients)

1 mol K = 39 g 1 mol Cl_2 = 71 g 1 mol KCl = 74.5 g

3) $2K + Cl_2 \rightarrow 2\ KCl$

A) 3 step problem [mass A] → [moles A] → [moles B] → [mass B]

$$\frac{2.5\ g\ K}{} \left| \frac{1\ mol\ K}{39\ g\ K} \right. \left| \frac{2\ mol\ KCl}{2\ mol\ K} \right. \left| \frac{74.5\ g\ KCl}{1\ mol\ KCl} \right. = \frac{372.5}{78} = 4.78\ g\ KCl$$

(molar mass | coefficients | molar mass)

B) also a 3 step problem

$$\frac{1.00\ g\ Cl_2}{} \left| \frac{1\ mol\ Cl_2}{71\ g\ Cl_2} \right. \left| \frac{2\ mol\ KCl}{1\ mol\ Cl_2} \right. \left| \frac{74.5\ g\ KCl}{1\ mol\ KCl} \right. = \frac{149}{71} = 2.10\ g\ KCl$$

(molar mass | coefficients | molar mass)

1 mol Na_2O = 62 g 1 mol H_2O = 18 g 1 mol NaOH = 40 g

4) $Na_2O + H_2O \rightarrow 2\ NaOH$

A) 3 step problem ($1.20 \times 10^2 = 120$)

$$\frac{120\ g\ Na_2O}{} \left| \frac{1\ mol\ Na_2O}{62\ g\ Na_2O} \right. \left| \frac{2\ mol\ NaOH}{1\ mol\ Na_2O} \right. \left| \frac{40\ g\ NaOH}{1\ mol\ NaOH} \right. = \frac{9600}{62} = 154.84\ g\ NaOH$$

B) 3 step problem ($1.60 \times 10^2 = 160$)

$$\frac{160\ g\ NaOH}{} \left| \frac{1\ mol\ NaOH}{40\ g\ NaOH} \right. \left| \frac{1\ mol\ Na_2O}{2\ mol\ NaOH} \right. \left| \frac{62\ g\ Na_2O}{1\ mol\ Na_2O} \right. = \frac{9920}{80} = 124\ g\ Na_2O$$

1 mol Fe = 56g 1 mol S_8 = 256g 1 mol FeS = 88g

5) $8\,Fe + S_8 \rightarrow 8\,FeS$

A) 3 step problem

$$\frac{16\,g\,S_8}{1} \left| \frac{1\,mol\,S_8}{256\,g\,S_8} \right| \frac{8\,mol\,Fe}{1\,mol\,S_8} \left| \frac{56\,g\,Fe}{1\,mol\,Fe} \right. = \frac{7168}{256} = 28\,g\,Fe$$

B) 3 step problem

$$\frac{16\,g\,S_8}{1} \left| \frac{1\,mol\,S_8}{256\,g\,S_8} \right| \frac{8\,mol\,FeS}{1\,mol\,S_8} \left| \frac{88\,g\,FeS}{1\,mol\,FeS} \right. = \frac{11264}{256} = 44\,g\,FeS$$

1 mol $NaClO_3$ = 106.5g 1 mol NaCl = 58.5g 1 mol O_2 = 32g

6) $2\,NaClO_3 \rightarrow 2\,NaCl + 3\,O_2$

A) 2 step problem mole A → mole B → mass B

$$\frac{12\,mol\,NaClO_3}{1} \left| \frac{3\,mol\,O_2}{2\,mol\,NaClO_3} \right| \frac{32\,g\,O_2}{1\,mol\,O_2} \left. = \frac{1152}{2} = 576\,g\,O_2 \right.$$

B) 3 step problem

$$\frac{80\,g\,O_2}{1} \left| \frac{1\,mol\,O_2}{32\,g\,O_2} \right| \frac{2\,mol\,NaCl}{3\,mol\,O_2} \left| \frac{58.5\,g\,NaCl}{1\,mol\,NaCl} \right. = \frac{9360}{96} = 97.5\,g\,NaCl$$

1 mol Cu = 63.5g 1 mol $AgNO_3$ = 170g 1 mol $Cu(NO_3)_2$ = 187.5g 1 mol Ag = 108g

7) $Cu + 2\,AgNO_3 \rightarrow Cu(NO_3)_2 + 2\,Ag$

A) 1 step problem mole A → mole B

$$\frac{3.5\,mol\,AgNO_3}{1} \left| \frac{1\,mol\,Cu}{2\,mol\,AgNO_3} \right. = \frac{3.5}{2} = 1.75\,mol\,Cu$$

B) 3 step problem

$$\frac{89.5\,g\,Ag}{1} \left| \frac{1\,mol\,Ag}{108\,g\,Ag} \right| \frac{1\,mol\,Cu}{2\,mol\,Ag} \left| \frac{63.5\,g\,Cu}{1\,mol\,Cu} \right. = \frac{5683.25}{216} = 26.3\,g\,Cu$$

1 mol Fe_2O_3 = 160g 1 mol C = 12g 1 mol Fe = 56g 1 mol CO = 28g

8) $Fe_2O_3 + 3\,C \rightarrow 2\,Fe + 3\,CO$

3 step problem (1000 g = 1 Kg)

$$\frac{25{,}000\,g\,Fe_2O_3}{1} \left| \frac{1\,mol\,Fe_2O_3}{160\,g\,Fe_2O_3} \right| \frac{2\,mol\,Fe}{1\,mol\,Fe_2O_3} \left| \frac{56\,g\,Fe}{1\,mol\,Fe} \right. = \frac{2800000}{160} = 17500\,g \rightarrow 17.5\,kg\,Fe$$

9) 1 mol CO_2 = 44g 1 mol H_2O = 18g 1 mol $C_6H_{12}O_6$ = 180g 1 mol O_2 = 32g

$$6\,CO_2 + 6\,H_2O \rightarrow C_6H_{12}O_6 + 6\,O_2$$

3 step problem

$$\frac{120.0\ \text{g } C_6H_{12}O_6 \mid 1\ \text{mol } C_6H_{12}O_6 \mid 6\ \text{mol } CO_2 \mid 44\text{g}}{180\ \text{g } C_6H_{12}O_6 \mid 1\ \text{mol } C_6H_{12}O_6 \mid 1\ \text{mol } CO_2} = \frac{31680}{180} = 176\ \text{g } CO_2$$

1 mol NH_3 = 17g 1 mol O_2 = 32g 1 mol NO = 30g 1 mol H_2O = 18g

10) $$4\,NH_3 + 5\,O_2 \rightarrow 4\,NO + 6\,H_2O$$

all are 1 step problems

$$\frac{1.20\ \text{mol } NH_3 \mid 4\ \text{mol NO}}{4\ \text{mol } NH_3} = \frac{4.8}{4} = 1.2\ \text{mol NO}$$

$$\frac{1.20\ \text{mol } NH_3 \mid 6\ \text{mol } H_2O}{4\ \text{mol } NH_3} = \frac{7.2}{4} = 1.8\ \text{mol } H_2O$$