Practice Problems Ans key Starman

Practice Problems 12

Section 12.1

1. $10A + 2C + Ci \rightarrow A_{10}C_2Ci$

$$25\ \cancel{A_{10}C_2Ci} \times \frac{10A}{\cancel{A_{10}C_2Ci}} = 250 \text{ apples}$$

2. $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$

$$12\ \cancel{\text{mol } KClO_3} \times \frac{3 \text{ mol } O_2}{2\ \cancel{\text{mol } KClO_3}} = 18 \text{ mol } O_2$$

3. $$14\ \cancel{\text{mol } KClO_3} \times \frac{3 \text{ mol } O_2}{2\ \cancel{\text{mol } KClO_3}} = 21 \text{ mol } O_2$$

4. $2H_2(s) + O_2(g) \rightarrow 2H_2O(g)$

$$2.0 \times 10^{23}\ \cancel{\text{molecules } O_2} \times \frac{2 \text{ molecules } H_2O}{1\ \cancel{\text{molecule } O_2}}$$

$$= 4.0 \times 10^{23} \text{ molecules } H_2O$$

$$22.5\ \cancel{\text{mol } O_2} \times \frac{2 \text{ mol } H_2O}{1\ \cancel{\text{mol } O_2}} = 45.0 \text{ mol } H_2O$$

Section 12.2

1. $$10\ \cancel{\text{mol } H_2} \times \frac{2 \text{ mol HCl}}{1\ \cancel{\text{mol } H_2}} = 20 \text{ mol HCl}$$

2. $$14\ \cancel{\text{mol } FeCl_3} \times \frac{3 \text{ mol } Cl_2}{2\ \cancel{\text{mol } FeCl_3}} = 21 \text{ mol } Cl_2$$

3. $$4\ \cancel{\text{mol NO}} \times \frac{2\ \cancel{\text{mol } NO_2}}{2\ \cancel{\text{mol NO}}} \times \frac{46 \text{ g } NO_2}{1\ \cancel{\text{mol } NO_2}}$$

$$= 184 \text{ g } NO_2$$

4. $$75.0\ \cancel{\text{g } KClO_3} \times \frac{1\ \cancel{\text{mol } KClO_3}}{122.6\ \cancel{\text{g } KClO_3}}$$

$$\times \frac{3\ \cancel{\text{mol } O_2}}{2\ \cancel{\text{mol } KClO_3}} \times \frac{32.0 \text{ g } O_2}{1\ \cancel{\text{mol } O_2}} = 29.4 \text{ g } O_2$$

5. $2Ag(s) + Cl(g) \rightarrow 2AgCl(s)$

$$84\ \cancel{\text{g AgCl}} \times \frac{1\ \cancel{\text{mol AgCl}}}{43.5\ \cancel{\text{g AgCl}}} \times \frac{2\ \cancel{\text{mol Ag}}}{2\ \cancel{\text{mol AgCl}}}$$

$$\times \frac{108 \text{ g Ag}}{1\ \cancel{\text{mol Ag}}} = 63 \text{ g Ag}$$

6. $$4.80\ \cancel{\text{g } O_2} \times \frac{1\ \cancel{\text{mol } O_2}}{32.0\ \cancel{\text{g } O_2}} \times \frac{2\ \cancel{\text{mol CO}}}{1\ \cancel{\text{mol } O_2}}$$

$$\times \frac{22.4 \text{ L CO}}{1\ \cancel{\text{mol CO}}} = 6.72 \text{ L CO}$$

7. $$15.0\ \cancel{\text{L } N_2O_3} \times \frac{3 \text{ L } O_2}{2\ \cancel{\text{L } N_2O_3}} = 22.5 \text{ L } O_2$$

8. $Zn(s) + 2HNO_3 \rightarrow H_2(g) + Zn(NO_3)_2$

$$7.5\ \cancel{\text{L } H_2} \times \frac{1\ \cancel{\text{mol } H_2}}{22.4\ \cancel{\text{L } H_2}} \times \frac{1\ \cancel{\text{mol Zn}}}{1\ \cancel{\text{mol } H_2}}$$

$$\times \frac{65.4 \text{ g Zn}}{1\ \cancel{\text{mol Zn}}} = 22 \text{ g Zn}$$

Section 12.3

1. $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

$$4\ \cancel{\text{mol } O_2} \times \frac{2 \text{ mol } H_2}{1\ \cancel{\text{mol } O_2}} = 8 \text{ mol } H_2$$

$$16\ \cancel{\text{mol } H_2} \times \frac{1 \text{ mol } O_2}{2\ \cancel{\text{mol } H_2}} = 8 \text{ mol } O_2$$

Oxygen is the limiting reagent.

$$4\ \cancel{\text{mol } O_2} \times \frac{2 \text{ mol } H_2O}{1\ \cancel{\text{mol } O_2}} = 8 \text{ mol } H_2O \text{ formed}$$

2. $2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

$$160.0\ \cancel{\text{g } O_2} \times \frac{1\ \cancel{\text{mol } O_2}}{32.0\ \cancel{\text{g } O_2}} \times \frac{2 \text{ mol } H_2}{1\ \cancel{\text{mol } O_2}}$$

$$= 10.0 \text{ mol } H_2 \text{ needed}$$

Oxygen is the limiting reagent.

$$5.00\ \cancel{\text{mol } O_2} \times \frac{2\ \cancel{\text{mol } H_2O}}{1\ \cancel{\text{mol } O_2}} \times \frac{18.0 \text{ g } H_2O}{1\ \cancel{\text{mol } H_2O}}$$

$$= 180 \text{ g } H_2O$$

3. $C(s) + O_2(g) \rightarrow CO_2(g)$

$$18.0\ \cancel{\text{g } C} \times \frac{1\ \cancel{\text{mol } C}}{12.0\ \cancel{\text{g } C}} \times \frac{1\ \cancel{\text{mol } CO_2}}{1\ \cancel{\text{mol } C}}$$

$$\times \frac{44.0 \text{ g } CO_2}{1\ \cancel{\text{mol } CO_2}} = 66.0 \text{ g } CO_2$$

$$\text{percent yield} = \frac{55.0 \text{ g } CO_2}{66.0 \text{ g } CO_2} \times 100\% = 83.3\%$$

4. $2HCl(g) \rightarrow H_2(g) + Cl_2(g)$

$$25.8\ \cancel{\text{g HCl}} \times \frac{1\ \cancel{\text{mol HCl}}}{36.5\ \cancel{\text{g HCl}}} \times \frac{1\ \cancel{\text{mol } Cl_2}}{2\ \cancel{\text{mol HCl}}}$$

$$\times \frac{71.0 \text{ g } Cl_2}{1\ \cancel{\text{mol } Cl_2}} = 25.1 \text{ g } Cl_2$$

$$\text{percent yield} = \frac{13.6 \text{ g } Cl_2}{25.1 \text{ g } Cl_2} \times 100\% = 54.2\%$$

5. $$100.0\ \cancel{\text{g AgCl}} \times \frac{1\ \cancel{\text{mol AgCl}}}{143.5\ \cancel{\text{g AgCl}}} \times \frac{2\ \cancel{\text{mol Ag}}}{2\ \cancel{\text{mol AgCl}}}$$

$$\times \frac{108 \text{ g Ag}}{1\ \cancel{\text{mol Ag}}} = 75.3 \text{ g Ag}$$

$$\text{mass of Ag}(s) \text{ reclaimed} = 0.946 \times 75.3 \text{ g Ag}$$

$$= 71.2 \text{ g Ag}$$

6. $$42.8\ \cancel{\text{g Mg}} \times \frac{1\ \cancel{\text{mol Mg}}}{24.3\ \cancel{\text{g Mg}}} \times \frac{2\ \cancel{\text{mol MgO}}}{2\ \cancel{\text{mol Mg}}}$$

$$\times \frac{40.3 \text{ g MgO}}{1\ \cancel{\text{mol MgO}}} = 71.0 \text{ g MgO}$$

$$\text{actual yield} = 71.0 \text{ g MgO} \times 0.817$$

$$= 58.0 \text{ g MgO}$$