Limiting Reactants — Answer Key

Instructor reference • Worked solutions in red

Explanations use introductory chemistry conventions. Equivalent valid structures or correctly rounded numeric answers may also receive credit.

1. $2\ H_2 + O_2 \rightarrow 2\ H_2O$ Start: 3 mol H_2 and 1 mol O_2. Identify the limiting reagent and calculate the theoretical moles of H_2O.

Ratios: H_2: 3/2 = 1.5; O_2: 1/1 = 1. Limiting: O_2. Product: 2 mol H_2O.

2. $2\ H_2 + O_2 \rightarrow 2\ H_2O$ Start: 6 mol H_2 and 4 mol O_2. Identify the limiting reagent and calculate the theoretical moles of H_2O.

Ratios: H_2: 6/2 = 3; O_2: 4/1 = 4. Limiting: H_2. Product: 6 mol H_2O.

3. $N_2 + 3\ H_2 \rightarrow 2\ NH_3$ Start: 1.5 mol N_2 and 3 mol H_2. Identify the limiting reagent and calculate the theoretical moles of NH_3.

Ratios: N_2: 1.5/1 = 1.5; H_2: 3/3 = 1. Limiting: H_2. Product: 2 mol NH_3.

4. $N_2 + 3\ H_2 \rightarrow 2\ NH_3$ Start: 2 mol N_2 and 9 mol H_2. Identify the limiting reagent and calculate the theoretical moles of NH_3.

Ratios: N_2: 2/1 = 2; H_2: 9/3 = 3. Limiting: N_2. Product: 4 mol NH_3.

5. $2\ Mg + O_2 \rightarrow 2\ MgO$ Start: 1 mol Mg and 0.75 mol O_2. Identify the limiting reagent and calculate the theoretical moles of MgO.

Ratios: Mg: 1/2 = 0.5; O_2: 0.75/1 = 0.75. Limiting: Mg. Product: 1 mol MgO.

6. $2\ Mg + O_2 \rightarrow 2\ MgO$ Start: 3 mol Mg and 1 mol O_2. Identify the limiting reagent and calculate the theoretical moles of MgO.

Ratios: Mg: 3/2 = 1.5; O_2: 1/1 = 1. Limiting: O_2. Product: 2 mol MgO.

7. $2\ Al + 3\ Cl_2 \rightarrow 2\ AlCl_3$ Start: 4 mol Al and 3 mol Cl_2. Identify the limiting reagent and calculate the theoretical moles of $AlCl_3$.

Ratios: Al: 4/2 = 2; Cl_2: 3/3 = 1. Limiting: Cl_2. Product: 2 mol $AlCl_3$.

8. $2\ Al + 3\ Cl_2 \rightarrow 2\ AlCl_3$ Start: 2 mol Al and 6 mol Cl_2. Identify the limiting reagent and calculate the theoretical moles of $AlCl_3$.

Ratios: Al: 2/2 = 1; Cl_2: 6/3 = 2. Limiting: Al. Product: 2 mol $AlCl_3$.

9. $4\ Fe + 3\ O_2 \rightarrow 2\ Fe_2O_3$ Start: 8 mol Fe and 3 mol O_2. Identify the limiting reagent and calculate the theoretical moles of Fe_2O_3.

Ratios: Fe: 8/4 = 2; O_2: 3/3 = 1. Limiting: O_2. Product: 2 mol Fe_2O_3.

10. $4\ Fe + 3\ O_2 \rightarrow 2\ Fe_2O_3$ Start: 2 mol Fe and 3 mol O_2. Identify the limiting reagent and calculate the theoretical moles of Fe_2O_3.

Ratios: Fe: 2/4 = 0.5; O_2: 3/3 = 1. Limiting: Fe. Product: 1 mol Fe_2O_3.

11. $2\ CO + O_2 \rightarrow 2\ CO_2$ Start: 1.2 mol CO and 0.4 mol O_2. Identify the limiting reagent and calculate the theoretical moles of CO_2.

Ratios: CO: 1.2/2 = 0.6; O_2: 0.4/1 = 0.4. Limiting: O_2. Product: 0.8 mol CO_2.

12. $2\ CO + O_2 \rightarrow 2\ CO_2$ Start: 0.8 mol CO and 1 mol O_2. Identify the limiting reagent and calculate the theoretical moles of CO_2.

Ratios: CO: 0.8/2 = 0.4; O_2: 1/1 = 1. Limiting: CO. Product: 0.8 mol CO_2.