

Section 3.2 Synthesis Reactions and Decomposition Reactions
Solutions for Practice Problems
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31. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of potassium bromide, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when potassium bromide decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: potassium bromide.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A binary compound is decomposing.

The products of the decomposition of a binary compound are two elements.

Word equation: potassium bromide \rightarrow potassium + bromine

Skeleton equation: $\text{KBr}(\ell) \rightarrow \text{K}(\ell) + \text{Br}_2(\ell)$

Reactants: 1 K^+ , 1 Br^-

Products: 1 K, 2 Br

Balanced chemical equation: $2\text{KBr}(\ell) \rightarrow 2\text{K}(\ell) + \text{Br}_2(\ell)$

The ratio of the coefficients is 2:2:1. This is the lowest possible ratio.

Reactants: 2 K^+ , 2 Br^-

Products: 2 K, 2 Br

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal halide.

The balanced chemical equation for this reaction is:



32. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of aluminum oxide, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when aluminum oxide decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: aluminum oxide.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A binary compound is decomposing.

The products of the decomposition of a binary compound are the two elements.

Word equation: aluminum oxide \rightarrow aluminum + oxygen

Skeleton equation: $\text{Al}_2\text{O}_3(\ell) \rightarrow \text{Al}(\ell) + \text{O}_2(\text{g})$

Reactants: 2Al^{3+} , 3O^{2-}

Products: 1 Al, 2 O

Balanced chemical equation: $2\text{Al}_2\text{O}_3(\ell) \rightarrow 4\text{Al}(\ell) + 3\text{O}_2(\text{g})$

The ratio of the coefficients is 2:4:3. This is the lowest possible ratio.

Reactants: 4Al^{3+} , 6O^{2-}

Products: 4 Al, 6 O

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal halide.

The balanced chemical equation for this reaction is:



33. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of magnesium hydroxide, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when magnesium hydroxide decomposes write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: magnesium hydroxide.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A metal hydroxide is decomposing.

A metal oxide and water are the usual products that form when a metal hydroxide decomposes.

Word equation: magnesium hydroxide \rightarrow magnesium oxide + water

Skeleton equation: $\text{Mg(OH)}_2(\text{s}) \rightarrow \text{MgO}(\text{s}) + \text{H}_2\text{O}(\text{g})$

Reactants: 1 Mg^{2+} , 2 OH^-

Products: 1 Mg^{2+} , 1 O^{2-} , 2 H, 1 O

Balanced chemical equation: $\text{Mg(OH)}_2(\text{s}) \rightarrow \text{MgO}(\text{s}) + \text{H}_2\text{O}(\text{g})$

The ratio of the coefficients is 1:1:1. This is the lowest possible ratio.

The skeleton and balanced equations are the same.

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal hydroxide.

The balanced chemical equation for this reaction is:



34. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of calcium nitrate, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when calcium nitrate decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: calcium nitrate.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A metal nitrate is decomposing.

A metal nitrite and oxygen are the usual products that form when a metal nitrate decomposes.

Word equation: calcium nitrate \rightarrow calcium nitrite + oxygen

Skeleton equation: $\text{Ca}(\text{NO}_3)_2(\text{s}) \rightarrow \text{Ca}(\text{NO}_2)_2(\text{s}) + \text{O}_2(\text{g})$

Reactants: 1 Ca^{2+} , 2 NO_3^-

Products: 1 Ca^{2+} , 2 NO_2^- , 2 O

Balanced chemical equation: $\text{Ca}(\text{NO}_3)_2(\text{s}) \rightarrow \text{Ca}(\text{NO}_2)_2(\text{s}) + \text{O}_2(\text{g})$

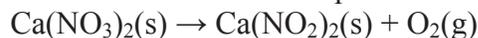
The ratio of the coefficients is 1:1:1. This is the lowest possible ratio.

The skeleton and balanced equations are the same.

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal nitrate.

The balanced chemical equation for this reaction is:



35. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of copper(II) carbonate, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when copper(II) carbonate decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: copper(II) carbonate.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A metal carbonate is decomposing.

A metal oxide and carbon dioxide are the usual products that form when a metal carbonate decomposes.

Word equation: copper(II) carbonate \rightarrow copper(II) oxide + carbon dioxide

Skeleton equation: $\text{CuCO}_3(\text{s}) \rightarrow \text{CuO}(\text{s}) + \text{CO}_2(\text{g})$

Reactants: 1 Cu^{2+} , 1 CO_3^{2-}

Products: 1 Cu^{2+} , 1 O^{2-} , 1 C, 2 O

Balanced chemical equation: $\text{CuCO}_3(\text{s}) \rightarrow \text{CuO}(\text{s}) + \text{CO}_2(\text{g})$

The ratio of the coefficients is 1:1:1. This is the lowest possible ratio.

The skeleton and balanced equations are the same.

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal carbonate.

The balanced chemical equation for this reaction is:



36. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of chromium(III) chloride, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when chromium(III) chloride decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: chromium(III) chloride.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A binary compound is decomposing.

The products of the decomposition of a binary compound are the two elements.

Word equation: chromium(III) chloride \rightarrow chromium + chlorine

Skeleton equation: $\text{CrCl}_3(\ell) \rightarrow \text{Cr}(\ell) + \text{Cl}_2(\text{g})$

Reactants: 1 Cr^{3+} , 3 Cl^-

Products: 1 Cr, 2 Cl

Balanced chemical equation: $2\text{CrCl}_3(\ell) \rightarrow 2\text{Cr}(\ell) + 3\text{Cl}_2(\text{g})$

The ratio of the coefficients is 2:2:3. This is the lowest possible ratio.

Reactants: 2 Cr^{3+} , 6 Cl^-

Products: 2 Cr, 6 Cl

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal halide.

The balanced chemical equation for this reaction is:



37. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of barium carbonate, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when barium carbonate decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: barium carbonate.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A metal carbonate is decomposing.

A metal oxide and carbon dioxide are the usual products that form when a metal carbonate decomposes.

Word equation: barium carbonate \rightarrow barium oxide + carbon dioxide

Skeleton equation: $\text{BaCO}_3(\text{s}) \rightarrow \text{BaO}(\text{s}) + \text{CO}_2(\text{g})$

Reactants: 1 Ba^{2+} , 1 CO_3^{2-}

Products: 1 Ba^{2+} , 1 O^{2-} , 1 C, 2 O

Balanced chemical equation: $\text{BaCO}_3(\text{s}) \rightarrow \text{BaO}(\text{s}) + \text{CO}_2(\text{g})$

The ratio of the coefficients is 1:1:1. This is the lowest possible ratio.

Reactants: 1 Ba^{2+} , 1 CO_3^{2-}

Products: 1 Ba^{2+} , 1 O^{2-} , 1 C, 2 O

The skeleton and balanced equations are the same.

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal carbonate.

The balanced chemical equation for this reaction is:



38. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of rubidium nitrate, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when rubidium nitrate decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: rubidium nitrate.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A metal nitrate is decomposing.

A metal nitrite and oxygen are the usual products that form when a metal nitrate decomposes.

Word equation: rubidium nitrate \rightarrow rubidium nitrite + oxygen

Skeleton equation: $\text{RbNO}_3(\text{s}) \rightarrow \text{RbNO}_2(\text{s}) + \text{O}_2(\text{g})$

Reactants: 1 Rb^+ , 1 NO_3^-

Products: 1 Rb^+ , 1 NO_2^- , 2 O

Balanced chemical equation: $2\text{RbNO}_3(\text{s}) \rightarrow 2\text{RbNO}_2(\text{s}) + \text{O}_2(\text{g})$

The ratio of the coefficients is 2:2:1. This is the lowest possible ratio.

Reactants: 2 Rb^+ , 2 NO_3^-

Products: 2 Rb^+ , 2 NO_2^- , 2 O

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal nitrate.

The balanced chemical equation for this reaction is:



39. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of lithium hydroxide, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when lithium hydroxide decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: lithium hydroxide.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A metal hydroxide is decomposing.

A metal oxide and water are the usual products that form when a metal hydroxide decomposes.

Word equation: lithium hydroxide \rightarrow lithium oxide + water

Skeleton equation: $\text{LiOH(s)} \rightarrow \text{Li}_2\text{O(s)} + \text{H}_2\text{O(g)}$

Reactants: 1 Li^+ , 1 OH^-

Products: 2 Li^+ , 1 O^{2-} , 2 H, 1 O

Balanced chemical equation: $2\text{LiOH(s)} \rightarrow \text{Li}_2\text{O(s)} + \text{H}_2\text{O(g)}$

The ratio of the coefficients is 2:1:1. This is the lowest possible ratio.

Reactants: 2 Li^+ , 2 OH^-

Products: 2 Li^+ , 1 O^{2-} , 2 H, 1 O

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal hydroxide.

The balanced chemical equation for this reaction is:



40. Practice Problem (page 134)

Determine the products that are likely to form in the decomposition of magnesium chloride, and write a balanced chemical equation for the reaction.

What Is Required?

You need to determine the products that are likely to form when magnesium chloride decomposes and write a balanced chemical equation for the reaction.

What Is Given?

You are given the type of reaction: decomposition.

You are given the reactant: magnesium chloride.

Plan Your Strategy

Identify the type of compound that is decomposing.

Determine the types of products that usually form in this type of reaction.

Write a word equation for the reaction.

Write and balance a chemical equation for the reaction.

Check to make sure that the ratio of the coefficients is the lowest possible ratio.

Check to make sure that the number of each kind of atom and ion is the same in the reactants and products.

Act on Your Strategy

A binary compound is decomposing.

The products of the decomposition of a binary compound are the two elements.

Word equation: magnesium chloride \rightarrow magnesium + chlorine

Skeleton equation: $\text{MgCl}_2(\ell) \rightarrow \text{Mg}(\ell) + \text{Cl}_2(\text{g})$

Reactants: 1 Mg^{2+} , 2 Cl^-

Products: 1 Mg, 2 Cl

Balanced chemical equation: $\text{MgCl}_2(\ell) \rightarrow \text{Mg}(\ell) + \text{Cl}_2(\text{g})$

The ratio of the coefficients is 1:1:1. This is the lowest possible ratio.

The skeleton and balanced equations are the same.

Check Your Solution

Each chemical formula is correct, and the chemical equation is balanced. The products are what you would expect to be produced from the decomposition of a metal halide.

The balanced chemical equation for this reaction is:

