

Some are Redox, Some not

Synthesis reactions occur when two substances join together to produce one, more complex compound. The starting substances can be elements or compounds. The product compound has more atoms than the reactant substances.

Written using generic symbols, it can be shown as:



Practice these examples: Predict the products, write the skeleton equation, then balance (answers on pg 2)

- A. magnesium metal reacts with oxygen gas
- B. hydrogen gas reacts with oxygen gas
- C. potassium reacts with chlorine gas
- D. iron reacts with oxygen gas (the iron will be III)

- Notice that three of these reactions (a, b, and d) would also fit into the combustion category as well as this synthesis category as long as the reaction occurred fast.
- Notice that two elements are combining in each example to produce one product.
- Don't forget about the diatomic gases (H₂ N₂ O₂ F₂ Cl₂ Br₂ I₂ At₂)
- Notice that unreacted metals are written as single atoms (no subscripts).

Synthesis can also be

- two compounds making a single more complex compound
- a compound and an element joining together to make a more complex compound

Practice these examples: Write the skeleton equation, then balance. (answers on pg 2)

- E. calcium oxide reacts with carbon dioxide to produce calcium carbonate
- F. sodium oxide reacts with carbon dioxide to produce sodium carbonate
- G. potassium chloride reacts with oxygen gas to produce potassium chlorate
- H. barium chloride reacts with oxygen gas to produce barium chlorate
- I. magnesium oxide reacts with water to produce magnesium hydroxide
- J. potassium oxide reacts with water to produce potassium hydroxide

Important Points to Remember (i.e. memorize)

- Notice that in ALL synthesis reactions there is only one substance on the product (right-hand) side. This is our definition of a synthesis reaction.
- You should notice some patterns above:
 - metal chlorides react with oxygen to produce the metal chlorate. (redox)
 - metal oxides react with carbon dioxide to produce the metal carbonate. (not redox)
 - metal oxides react with water to produce a metal hydroxide solution. (not redox)
 - (nonmetal oxides react with water to produce acids, you will not be asked to predict these products.)
- Reactions will be redox if at least one (or more) of the reactants is an element, not just compounds.
- Don't forget about the acid formulas. You should learn how to name them (NS E6) and remember the strong acids.
 - * hydrochloric acid – HCl (strong acid)
 - * nitric acid – HNO₃ (strong acid)
 - * sulfuric acid – H₂SO₄ (strong acid)
 - * carbonic acid – H₂CO₃ (weak acid)
 - * phosphoric acid – H₃PO₄ (weak acid)
 - * acetic acid – HC₂H₃O₂ (weak acid)

ANSWERS

- A. (produces magnesium oxide)
- skeleton: $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$
 - balanced: $2 \text{Mg} + \text{O}_2 \rightarrow 2 \text{MgO}$ (redox)
- B. (produces water)
- skeleton: $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
 - balanced: $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$ (redox)
- C. (produces potassium chloride)
- skeleton: $\text{K} + \text{Cl}_2 \rightarrow \text{KCl}$
 - balanced: $2 \text{K} + \text{Cl}_2 \rightarrow 2 \text{KCl}$ (redox)
- D. (produces iron(III) oxide)
- skeleton: $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$
 - balanced: $4 \text{Fe} + 3 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3$ (redox)
- E. skeleton: $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3$
- already balanced (not redox)
- F. skeleton: $\text{Na}_2\text{O} + \text{CO}_2 \rightarrow \text{Na}_2\text{CO}_3$
- already balanced (not redox)
- G. skeleton: $\text{KCl} + \text{O}_2 \rightarrow \text{KClO}_3$
- balanced: $2 \text{KCl} + 3 \text{O}_2 \rightarrow 2 \text{KClO}_3$ (redox)
- H. skeleton: $\text{BaCl}_2 + \text{O}_2 \rightarrow \text{Ba}(\text{ClO}_3)_2$
- balanced: $\text{BaCl}_2 + 3 \text{O}_2 \rightarrow \text{Ba}(\text{ClO}_3)_2$ (redox)
- I. skeleton: $\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2$
- already balanced (not redox)
- J. skeleton: $\text{K}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{KOH}$
- balanced: $\text{K}_2\text{O} + \text{H}_2\text{O} \rightarrow 2 \text{KOH}$ (not redox)