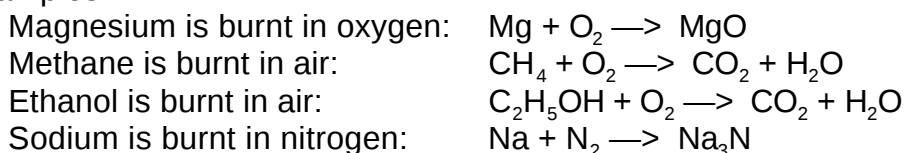


Student Packet: 9.4: Combustion/Decomposition Reactions: Student Handout**Combustion reactions**

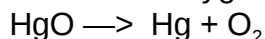
Combustion means that you burn something. Look for “burn” in the problem statement. Species may be combusted in oxygen or nitrogen. Remember that air is a mixture of oxygen and nitrogen (79% N₂ and 21% O₂). The most stable oxides and/or nitrides are the products of a combustion reaction. The nitrides are often left out of a combustion in air.

examples:

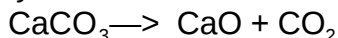
**Decomposition reactions**

Memorize the following. Look for “heated” or “decomposes.”

metal oxides — decompose to yield a metal and oxygen.



metal carbonates — decompose to yield the metal oxide and carbon dioxide.



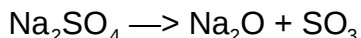
metal bicarbonates — decompose to yield the metal oxide, CO₂ and H₂O.



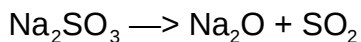
metal nitrates — decompose to yield the metal oxide, NO₂ and O₂.



metal sulfates — decompose to yield the metal oxide and SO₃.



metal sulfites — decompose to yield the metal oxide and SO₂.



Student Packet: 9.4: Combustion/Decomposition Reactions: AssessMe questions

- 1) Good laboratory technique specifies that you should never:
- A) Wash your hands with soap.
 - B) Add water to acid.
 - C) Add acid to water.
 - D) Put baking soda on an acid spill.
 - E) I'm clueless
- 2) X moles of a Brønsted acid will _____ neutralize X moles of a Lewis acid.
- A) always B) sometimes C) never D) never completely E) I'm clueless
- 3) If a mixture of acetylene and methane of unknown proportions is burned in excess oxygen, what is needed to determine the amount of each hydrocarbon originally present?
- A) the moles of CO_2 produced
 - B) the moles of H_2O produced
 - C) the moles of oxygen consumed
 - D) both (A) and (B)
 - E) I'm clueless
- 4) If morphine ($\text{C}_{17}\text{H}_{19}\text{NO}_3$) is burned in oxygen, how many moles of water are produced for every mole of NO_x produced?
- A) 17 B) 9.5 C) 9 D) 1 E) I'm clueless
- 5) What are the units of a rate constant for a fourth order reaction?
- A) M/s B) $1/(\text{s} \cdot \text{M}^4)$ C) $1/(\text{s} \cdot \text{M}^3)$ D) $1/(\text{s}^2 \cdot \text{M}^3)$ E) I'm clueless
- 6) What are the units of a rate constant for a second order reaction involving a gas and a liquid reactant?
- A) $\text{M} \cdot \text{atm/s}$ B) $1/(\text{s} \cdot \text{M})$ C) $1/(\text{s} \cdot \text{atm})$ D) $1/(\text{s} \cdot \text{M} \cdot \text{atm})$ E) I'm clueless

Student Packet: 9.4: Combustion/Decomposition Reactions: ShowMe questions

Write the net ionic equation for each of the reactions.

- 1) Mercury oxide solid is heated.

Lithium metal is burned in nitrogen.

Butane is burned in air.

- 2) Magnesium carbonate decomposes.

Solid bismuth is burned in excess oxygen.

Aluminum metal is burned in air.

- 3) Copper (II) nitrate is gently heated.

Ethanol is burned in excess oxygen.

Gaseous silane is burned in oxygen.

Student Packet: 9.4: Combustion/Decomposition Reactions: TestMe questions

- 1) Gaseous ammonia is burned in oxygen. Write the net ionic equation. (Don't balance the equation)
- A) $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO}_2 + \text{H}_2\text{O}$
B) $\text{NH}_4^+ + \text{O}_2 \rightarrow \text{NH}_3 + \text{H}_2\text{O}$
C) $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO}_2$
D) $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO} + \text{H}_2$
E) None of the above
- 2) Calcium hydrocarbonate decomposes. Write the net ionic equation. (Don't balance the equation)
- A) $\text{CaCO}_3 \rightarrow \text{CO}_2 + \text{Ca}^{2+}$
B) $\text{CaHCO}_3 \rightarrow \text{CaO} + \text{CO}_2 + \text{H}_2\text{O}$
C) $\text{Ca}(\text{CO}_3)_2 \rightarrow \text{CaO} + \text{CO}_2$
D) $\text{Ca}(\text{HCO}_3)_2 \rightarrow \text{CaO} + \text{CO}_2 + \text{H}_2\text{O}$
E) None of the above
- 3) Calcium metal is burned in nitrogen gas. Write the net ionic equation. (Don't balance the equation)
- A) $\text{Ca} + \text{O}_2 \rightarrow \text{CaO}$
B) $\text{Ca} + \text{O}_2 + \text{N}_2 \rightarrow \text{CaO} + \text{Ca}_3\text{N}_2$
C) $\text{Ca} + \text{N}_2 \rightarrow \text{Ca}_3\text{N}_2$
D) $\text{Ca} + \text{N}_2 \rightarrow \text{CaN}$
E) None of the above
- 4) Propanol is completely burned in air. Write the net ionic equation. (Don't balance the equation)
- A) $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 + \text{N}_2 \rightarrow \text{CO}_2 + \text{NO}_2 + \text{H}_2\text{O}$
B) $\text{C}_3\text{H}_7\text{OH} + \text{O}_2 + \text{N}_2 \rightarrow \text{CO}_2 + \text{NO}_2 + \text{H}_2\text{O}$
C) $\text{C}_4\text{H}_9\text{OH} + \text{O}_2 + \text{N}_2 \rightarrow \text{CO}_2 + \text{NO}_2 + \text{H}_2\text{O}$
D) $\text{C}_3\text{H}_8 + \text{O}_2 + \text{N}_2 \rightarrow \text{CO}_2 + \text{NO}_2 + \text{H}_2\text{O}$
E) None of the above
- 5) Potassium sulfite is heated. Write the net ionic equation. (Don't balance the equation)
- A) $\text{K}_2\text{SO}_3 \rightarrow \text{K}_2\text{O} + \text{SO}_2$
B) $\text{K}_2\text{SO}_4 \rightarrow \text{K}_2\text{O} + \text{SO}_3$
C) $\text{K}_2\text{SO}_3 \rightarrow \text{K}^+ + \text{O}_2 + \text{S}$
D) $\text{K}_2\text{SO}_3 \rightarrow \text{K}_2\text{O} + \text{O}_2 + \text{S}$
E) None of the above