CHEMISTRY

COMBUSTION REACTIONS

Combustion reactions are extremely important to our modern day society. The burning of fuel allows us to heat our homes, cook our food, generate electricity, and power our automobiles. In all combustion reactions, energy is released in the forms of light and heat when the bonds of the fuel are broken.

In order for a combustion reaction to take place, you need three ingredients.

- Fuel (normally a hydrocarbon)
- Oxygen gas
- A form of ignition

Complete Combustion

A complete combustion reaction has plenty of oxygen gas to burn the fuel. A complete combustion reaction will burn clean, producing no smoke.

Ex: Complete combustion of methane

$$CH_4 + 2\,O_2 \rightarrow 2\,H_2O + CO_2$$

Ex: Complete combustion of Wood (Primarily cellulose $C_6H_{10}O_5$)

$$\_\_\_\ C_6H_{10}O_5 + \_\_\_\ O_2 \rightarrow$$

Ex: Complete combustion of 2-methylpropane

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Incomplete Combustion

In the absence of sufficient oxygen, carbon-containing compounds undergo incomplete combustion. An incomplete combustion reaction can be recognized as a "dirty" fire that produces smoke and poisonous carbon monoxide. Incomplete combustion also results from burning a non-pure fuel source.

Ex: Incomplete combustion of methane

$$2\ CH_4 + 3\ O_{2(limited)} \rightarrow 2\ CO + 4\ H_2O$$

Ex: Incomplete combustion of Wood (Primarily cellulose $C_6H_{10}O_5$)

$$\_\_\_\ C_6H_{10}O_5 + \_\_\_\ O_{2(limited)} \rightarrow$$

Ex: Incomplete combustion of 3,4-diethylhexane

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Predicting Products of Chemical Reactions

This worksheet is designed to help you predict products of simple reactions of the four basic reaction types (synthesis, decomposition, single replacement, and double replacement) and combustion reactions.

a. Combustion: C_6H_{12} + O_2 →

b. Combustion: C_4H_6 + O_2 →

c. Combustion: $C_6H_{10}O_3$ + O_2 →

1. Synthesis: Mg + I_2 →

2. Double displacement: $CuCl_2$ + H_2S →

3. Double displacement: NaOH + $HClO_4$ →

4. Decomposition: $ZnCO_3$ + heat →

5. Single replacement: HCl + Zn →

6. _____ Na + $MgCl_2$ →

7. _____ $CaCl_2$ + K_2CO_3 →

8. _____ K + Cl_2 →

9. _____ $BaCl_2$ + K_3PO_4 →

10. _____ H_2SO_4 + KOH →

11. _____ $Al_2(CO_3)_3$ + heat →

12. _____ Al + O_2 →

13. _____ $Pb(NO_3)_2$ + KOH →

14. _____ H_2SO_4 + $BaCl_2$ →

15. _____ Ca + AgCl →

16. _____ H_3PO_4 + $FeBr_3$ →

17. _____ Li + N_2 →

18. _____ HCl + $Mg(OH)_2$ →

19. _____ $Mg(OH)_2$ + heat →

20. _____ $Fe(OH)_3$ + heat →