## Combustion Analysis Worksheet

## Combustion Analysis Process

Given:
Mass of hydrocarbon (unnecessary)
Mass of $\mathrm{O}_{2}$
Mass of $\mathrm{CO}_{2}$
Mass of $\mathrm{H}_{2} \mathrm{O}$
Mass of $\mathrm{N}_{2}$ (possibly)
Find:
Empirical formula of hydrocarbon

1. Convert mass of $\mathrm{CO}_{2}$ to moles of carbon atoms.

- calculation yields moles of carbon in hydrocarbon sample.

2. Convert mass of $\mathrm{H}_{2} \mathrm{O}$ to moles of hydrogen atoms.

- because there are two moles of hydrogen to one mole of water, multiply result by 2 to yield moles of hydrogen in hydrocarbon sample.

3. Convert mass of $\mathrm{N}_{2}$ to moles of nitrogen atoms.

- because there are two moles of nitrogen atoms in one mole of nitrogen molecules, multiply result by 2 to yield moles of nitrogen in hydrocarbon sample.

4. Calculate moles of oxygen atoms used from molecular oxygen.

- moles of oxygen $=1 / 2 \times$ moles of $\mathrm{O}_{2}$

4. Calculate moles of oxygen in products.

- moles of oxygen $=2 \times$ moles of $\mathrm{CO}_{2}+$ moles of $\mathrm{H}_{2} \mathrm{O}$

5. Calculate moles of oxygen in hydrocarbon

- moles of hydrocarbon oxygen = moles of oxygen in products - moles of oxygen used

6. Divide molar amounts by smallest of the values to find molar ratios in terms of whole numbers.

## Combustion Analysis Problems

1. A hydrocarbon fuel is fully combusted with 18.214 g of oxygen to yield 23.118 g of carbon dioxide and 4.729 g of water. Find the empirical formula for the hydrocarbon.
2. After combustion with excess oxygen, a 12.501 g of a petroleum compound produced 38.196 $g$ of carbon dioxide and 18.752 of water. A previous analysis determined that the compound does not contain oxygen. Establish the empirical formula of the compound.
3. In the course of the combustion analysis of an unknown compound, 12.923 g of carbon dioxide, 6.608 g of water and 2.057 g of nitrogen was measured. The complete combustion of 11.014 g of the compound needed 10.573 g of oxygen. What the compound's empirical formula?
$4 \quad 12.915 \mathrm{~g}$ of a biochemical substance was burned in an atmosphere of 50.123 g of oxygen. Subsequent analysis of the gaseous result yielded 18.942 g carbon dioxide, 7.749 g of water and 36.347 g of oxygen. Determine the empirical formula of the substance.
4. 33.658 g of oxygen was used to completely react with a sample of a hydrocarbon in a combustion reaction. The reaction products were 33.057 g of carbon dioxide and 10.816 g of water. Ascertain the empirical formula of the compound.
