Combustion Analysis Empirical Formula

1. 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.

$$38.196 g of CO\_{2} × \frac{1 mol CO\_{2}}{44.0g CO\_{2}} × \frac{1 mol C}{1 mol CO\_{2}}= 0.8677mol C$$

$$38.196 g H\_{2}O × \frac{1 mol H\_{2}O}{18.02g H\_{2}O} × \frac{2 mol H}{1 mol H\_{2}O}= 2.082 mol H   $$

$$C\_{\frac{0.8677}{0.8677}}H\_{\frac{2.082}{0.8677}}$$

$$C\_{1}H\_{2.4}\rightarrow C\_{5}H\_{12}$$

1. In a quantitative analysis study, 0.822 g of a compound containing carbon, hydrogen and oxygen only yielded 2.01 g of CO2 and 0.818 g of H2O in a combustion analysis apparatus. Determine the empirical formula of the compound

$2.01 g of CO\_{2} × \frac{1 mol CO\_{2}}{44.0g CO\_{2}} × \frac{1 mol C}{1 mol CO\_{2}} × \frac{12.01 g C}{1 mol C}=0.5487 g C $

$$0.818 g H\_{2}O × \frac{1 mol H\_{2}O}{18.02g H\_{2}O} × \frac{2 mol H}{1 mol H\_{2}O} ×\frac{1.01g H}{1 mol H}=0.091616 g H   $$

Total= mass C + mass H + mass O

0.822 g= 0.5487 g C + 0.091616 g H  +mass O

Mass O= 0.181 g O



$$C\_{4}H\_{8}O\_{1}$$

1. Menthol, the substance we can smell in mentholated cough drops, is composed of C, H, and O. A 0.1005 g sample of menthol is combusted, producing 0.2829 g of CO2 and 0.1159 g of H2O. What is the empirical formula for menthol?

$0.2829 g of CO\_{2} × \frac{1 mol CO\_{2}}{44.0g CO\_{2}} × \frac{1 mol C}{1 mol CO\_{2}}= 0.006430 mol C × \frac{12.01 g C}{1 mol C}=0.07716 g C $

$$0.1159 g H\_{2}O × \frac{1 mol H\_{2}O}{18.02g H\_{2}O} × \frac{2 mol H}{1 mol H\_{2}O}= 0.01288 mol H ×\frac{1.01g H}{1 mol H}=0.01288 g H   $$

Total= mass C + mass H + mass O

Mass O= $0.01046g O$

$0.01046g O × \frac{1 mol O}{16.00 g O}= 0.0006538 mol O   $

$$C\_{\frac{0.006430}{0.0006538}}H\_{\frac{0.01288}{0.0006538}}O\_{\frac{0.0006538}{0.0006538}}$$

$$C\_{10}H\_{20}O\_{1}$$

1. Combustion analysis of 0.1500 g of methyl tert-butyl ether, (CxHyOz), an octane booster used in gasoline, gave 0.3744 g of carbon dioxide and 0.1838 g of water vapor. What is the empirical formula of methyl tert-butyl ether?



empirical formula is C5H12O

1. When 6.853 mg of a sex hormone containing C, H, and O was burned in a combustion analysis, 19.73 mg of CO2 and 6.391 mg of H2O were obtained. What is the empirical formula of the compound?

$?mg C=19.73 mg CO\_{2}×\frac{1 mmol CO\_{2}}{44.01 mgCO\_{2} }×\frac{1 mmol C}{1 mmol CO\_{2}}=0.4483 mmol C×\frac{12.01 mg C}{1 mmol C}=5.384 mg C (78.56\% C)$

$?mg H=6.391 mg H\_{2}O×\frac{1 mmol H\_{2}O}{18.02 mg H\_{2}O }×\frac{2 mmol H}{1 mmol H\_{2}O}=0.7093 mmol H×\frac{1.008 mg H}{1 mmol H} =0.7150 mg H $(10.43% H)

$$?mg O=\left(6.853 mg-\left(5.384 mg C+0.7150 mgH\right)\right)=6.853mg-6.099mg=0.754 mg O (11.00\% O)$$

$$?mmol O=0.754 mg O×\frac{1 mmol O}{16.00 mg O}=0.0471 mmol O$$

$$C\_{\frac{0.4483}{0.0471}}H\_{\frac{0.7093}{0.0471}}O\_{\frac{0.0471}{0.0471}}$$

$$C\_{9.51}H\_{15}O\_{1}\rightarrow C\_{19}H\_{30}O\_{2}$$