Problem Set Chapter 3, Part 2

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1. Balance the following:

(a)
$$Zn(C_2H_3O_2)_2 + Na_3PO_4 \rightarrow NaC_2H_3O_2 + Zn_3(PO_4)_2$$

 $3Zn(C_2H_3O_2)_2 + 2Na_3PO_4 \rightarrow 6NaC_2H_3O_2 + Zn_3(PO_4)_2$

(b)
$$Ca_{10}F_2(PO_4)_6 + H_2SO_4 \to HF + Ca(H_2PO_4)_2 + CaSO_4$$

 $Ca_{10}F_2(PO_4)_6 + 7H_2SO_4 \to 2HF + 3Ca(H_2PO_4)_2 + 7CaSO_4$

(c)
$$C_2H_6 + O_2 \rightarrow CO_2 + H_2O_3$$

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

2. Calculate the number of grams of both products when 17.8[g] of C_3H_8 is combusted.

(a)
$$C_3H_8 + 5O_2 \rightarrow 4H_2O + 3CO_2$$

$$\frac{17.8[g]}{44[g \, \text{mol}^{-1}]} = .4[\text{mol}_{C_3H_8}] \rightarrow 2[\text{mol}_{O_2}], \ 1.6[\text{mol}_{H_2O}], \ 1.2[\text{mol}_{CO_2}]$$
$$1.6[\text{mol}] \cdot 18[g \, \text{mol}^{-1}] = 28.8[g]$$
$$1.2[\text{mol}] \cdot 44[g \, \text{mol}^{-1}] = 52.8[g]$$

3. A 0.1204[g] sample of carboxylic acid (containing C, O, and H) is burned in oxygen to yield 0.2147[g] of carbon dioxide and 0.0884[g] of water. Calculate the empirical formula.

$$.2147 \cdot \frac{12}{44} = .059[g_C], \ .0884 \cdot \frac{2}{18} = .0098[g_H], \ .1204 - .0098 - .059 = .0516[g_O]$$
$$\frac{.059}{12} = .0049[\text{mol}_C], \ \frac{.0098}{1} = .0098[\text{mol}_H], \ \frac{.0516}{16} = .0032[\text{mol}_O]$$

$$C_3H_6O_2$$

- 4. Phenol contains C, H, and O. Combustion of 2.136[mg] of phenol gives 5.993[mg] of CO_2 and $1.227[mg_{H_2O}]$. What is the simplest formula?
- 5. Kerosene $(C_{14}H_{30})$ has a density of $0.763[g\,\text{mL}^{-1}]$. How many grams of carbon dioxide are produced by the combustion of 3.785[L] of kerosene?
- 6. How many liters of CH_3CH_2OH (density = 0.789[g mL⁻¹]) must be consumed to produce 25[L]] of CH_3CHO (density = 0.788[g mL⁻¹])?

$$CH_3CH_2OH + O_{23}CHO + H_2O$$