Question 1 – A 37.64 g sample of an unknown organic compound containing only C, H, and O was burned in air to produce 105.6 g of CO_2 and 21.6 g of water. The compound was determined to have a molar mass of 94.11 g/mol. Determine the empirical and molecular formulas of the unknown compound.

$$C_xH_yO_z + excess\ O_2 \rightarrow x\ CO_2 + \frac{y}{2}H_2O$$

$$n_C = x = \frac{105.6\ g}{(12.01 + 2 \times 16.00)g/mol} = 2.400\ mol$$

$$\frac{y}{2} = \frac{21.6\ g}{(16.00 + 2 \times 1.008)g/mol} = 1.20\ mol$$

$$n_H = y = 2 \times 1.20\ mol = 2.40\ mol$$

$$m_C = 2.400\ mol \times 12.01\frac{g}{mol} = 28.82\ g$$

$$m_H = 2.40\ mol \times 1.008\frac{g}{mol} = 2.42\ g$$

$$m_O = 37.64 - 28.82 - 2.42\ g = 6.40\ g$$