

Solutions

Each answer shows the steps, then the **result**.

2.1

- a compound made up of only carbon and hydrogen atoms

2.2

- C_5H_{12}

3.1 B

- The empirical formula is the simplest whole-number ratio

3.2 A

- $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ is propan-1-ol

3.3

(a)

- a four-carbon zigzag with a methyl branch on the second carbon

(b)

- $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$

3.4

- they all have the same functional group, which determines their chemical reactions

3.5

(a)

- $n(\text{CO}_2) = \frac{17.6}{44.0} = 0.400$ mol, so 4 C per molecule; $n(\text{H}_2\text{O}) = \frac{7.20}{18.0} = 0.400$ mol, giving 0.800 mol H, so 8 H per molecule; C_4H_8 has a mass of 56.0, leaving $88.0 - 56.0 = 32.0$, i.e. **2** oxygens; molecular formula $\text{C}_4\text{H}_8\text{O}_2$

(b)

- $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$; **butanoic acid**

(c)

- Any ester of formula $\text{C}_4\text{H}_8\text{O}_2$ drawn with every bond shown — e.g. methyl propanoate $\text{CH}_3\text{CH}_2\text{COOCH}_3$, or ethyl ethanoate $\text{CH}_3\text{COOCH}_2\text{CH}_3$

(d)

- Empirical = simplest whole-number ratio, $\text{C}_2\text{H}_4\text{O}$; molecular = the actual number of each atom, $\text{C}_4\text{H}_8\text{O}_2$; structural = shows how the atoms are joined, $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$