WS 4.2: Empirical Formula Problems

Directions: Determine the empirical formula for the following substances. If a molecular formula cannot be reduced, write “cannot be reduced in the box for empirical formula.”

<table>
<thead>
<tr>
<th>Molecular Formula</th>
<th>Empirical Formula</th>
<th>Molecular Formula</th>
<th>Empirical Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{C}_6\text{H}_6 )</td>
<td>( \text{CH} )</td>
<td>( \text{C}<em>{10}\text{H}</em>{18} )</td>
<td>( \text{C}_5\text{H}_9 )</td>
</tr>
<tr>
<td>( \text{C}<em>8\text{H}</em>{18} )</td>
<td>( \text{C}_4\text{H}_9 )</td>
<td>( \text{C}<em>7\text{H}</em>{15}\text{O}_2 )</td>
<td>Not reducible</td>
</tr>
<tr>
<td>( \text{WO}_2 )</td>
<td>Not reducible</td>
<td>( \text{N}_2\text{H}_4 )</td>
<td>( \text{NH}_2 )</td>
</tr>
<tr>
<td>( \text{C}_2\text{H}_6\text{O}_2 )</td>
<td>( \text{CH}_3\text{O} )</td>
<td>( \text{P}_3\text{F}_6 )</td>
<td>( \text{PF}_2 )</td>
</tr>
<tr>
<td>( \text{X}<em>{39}\text{Y}</em>{13} )</td>
<td>( \text{X}_3\text{Y} )</td>
<td>( \text{IF}_5 )</td>
<td>Not reducible</td>
</tr>
<tr>
<td>( \text{C}<em>4\text{H}</em>{10} )</td>
<td>( \text{C}_2\text{H}_5 )</td>
<td>( \text{N}_2\text{O}_5 )</td>
<td>Not reducible</td>
</tr>
<tr>
<td>( \text{C}<em>6\text{H}</em>{12}\text{O}_6 )</td>
<td>( \text{CH}_2\text{O} )</td>
<td>( \text{N}_2\text{O}_4 )</td>
<td>( \text{NO}_2 )</td>
</tr>
<tr>
<td>( \text{P}_2\text{F}_4 )</td>
<td>( \text{PF}_3 )</td>
<td>( \text{SF}_6 )</td>
<td>Not reducible</td>
</tr>
<tr>
<td>( \text{SO}_3 )</td>
<td>Not reducible</td>
<td>( \text{N}_2\text{Cl}_4 )</td>
<td>( \text{NCl}_2 )</td>
</tr>
<tr>
<td>( \text{N}_2\text{Br}_4 )</td>
<td>( \text{NBr}_2 )</td>
<td>( \text{P}_2\text{O}_5 )</td>
<td>Not reducible</td>
</tr>
</tbody>
</table>

Directions: Solve the following problems. You may need to use a separate sheet of paper.

1) What is the empirical formula for a compound which contains 0.0134 g of iron, 0.00769 g of sulfur and 0.0115 g of oxygen?

\[ \text{FeSO}_3 \]

2) A compound is found to contain 53.7 % iron and 46.27 % sulfur. Find its empirical formula.

\[ \text{Fe}_2\text{S}_3 \]

3) Barry Um has a sample of a compound which weighs 200 grams and contains only carbon, hydrogen, oxygen and nitrogen. By analysis, he finds that it contains 97.56 grams of carbon, 4.878 g of hydrogen, 52.03 g of oxygen and 45.53 g of nitrogen. Find its empirical formula.

\[ \text{C}_5\text{H}_3\text{N}_2\text{O}_2 \]

4) What is the empirical formula for a compound which contains 80.3% zinc and the rest is oxygen?

\[ \text{ZnO} \]
5) Rubbing alcohol was found to contain 60.0% carbon, 13.4% hydrogen, and the remaining mass was due to oxygen. What is the empirical formula of rubbing alcohol?

\[ \text{C}_3\text{H}_8\text{O} \]

9) Give the name and empirical formula of a compound which contains 0.463 g Thallium, 0.0544 g of carbon, 0.00685 g of hydrogen and 0.0725 g oxygen.

\[ \text{TlC}_2\text{O}_2\text{H}_3 \]

6) If 4.04 g of Nitrogen combine with 11.46 g Oxygen to produce a compound with a molar mass of 108.0 g/mol, what is the empirical formula of this compound?

\[ \text{N}_2\text{O}_5 \]

10) A compound was analyzed and found to contain 13.5 g Ca, 10.8 g O, and 0.675 g H. What is the empirical formula of the compound? If the compound is ionic, what is the correct chemical formula?

\[ \text{CaO}_2\text{H}_2 \]

But knowing what we know about ionic compounds the correct chemical formula would be:

\[ \text{Ca(OH)}_2 \]

7) What’s the empirical formula of a molecule containing 18.7% lithium, 16.3% carbon, and 65.0% oxygen?

\[ \text{Li}_2\text{CO}_3 \]

11) What is the simplest formula of a substance which contains about 94% sulfur and about 6% hydrogen?

\[ \text{SH}_2 \]

8) A sample of indium chloride weighing 0.5000 g is found to contain 0.2404 g of chlorine. What is the empirical formula of the indium compound?

\[ \text{InCl}_3 \]

12) Find the empirical formula for a substance with the following mass percentages:

\[ \text{Al} = 22\% , \text{P} = 25\% , \text{and O} = 53\% . \]

\[ \text{AIPO}_4 \]