Name: ________________________________

**Answer Key: Percent Composition**

**Problem**
What is the percent composition of sugar in bubble gum and water in popcorn?

**Safety**
- Goggles should be worn throughout the investigation.
- Food should never be consumed in a lab setting. The group member who chews the gum should do so outside of the lab.
- The gum should never touch the surface of the balance. Only the gum chewer will handle their piece of gum.
- Always be cautious around a Bunsen burner. If you don’t feel comfortable lighting it yourself, ask your teacher for assistance.
- Food should never be consumed in a lab setting. Do not eat the popcorn, it should be discarded once the final data are collected.

**Materials**
- Pieces of bubble gum (different flavors)
- Balance
- Timer
- 75 popcorn kernels
- Heavy duty aluminum foil
- 250-mL beaker
- Bunsen burner
- Tongs/forceps
- Goggles

**Procedure**

**BUBBLE GUM**
1. Identify who will be the gum chewer. They will need to chew a piece of gum for 15 minutes.
2. Determine the mass of the unchewed gum. The gum cannot touch the surface of the balance. Note the flavor. Do not discard the wrapper.
3. Chew gum for 5 minutes.
4. Remass the gum, making sure it does not touch the balance.
5. Repeat for two more 5 minute chew cycles, remass after each cycle.

**POPCORN**
1. Determine the mass of 25 popcorn kernels.
2. Use aluminum foil to make a bowl for the kernels. Use a 250-mL beaker as a mold for the bowl, but do not keep the foil in the beaker.
3. Place the kernels in the bowl. Use another piece of foil to cover the bowl and seal the two pieces of foil by folding them together so the popcorn does not fly out.
4. Pop the kernels carefully over the Bunsen burner, using the tongs or forceps to gently heat the aluminum bowl. Shake regularly to ensure not burning a hole in the aluminum.
5. Once your kernels have all popped, take the final mass of the popcorn.
6. Dispose of the popcorn, do not eat it.
7. Repeat the steps for a second and third set of data.
Results

**BUBBLE GUM**

<table>
<thead>
<tr>
<th>Flavor</th>
<th>Masses will vary depending on type of gum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass of unchewed gum on wrapper</td>
<td>6.78 g</td>
</tr>
<tr>
<td>Mass of wrapper alone</td>
<td>0.22 g</td>
</tr>
<tr>
<td>Mass of unchewed gum</td>
<td>6.78 g – 0.22 g = 6.56 g</td>
</tr>
<tr>
<td>Mass of gum on wrapper after 5 min chewing</td>
<td>2.85 g</td>
</tr>
<tr>
<td>Mass of gum after 5 min chewing</td>
<td>2.85 g – 0.22 g = 2.63 g</td>
</tr>
<tr>
<td>Mass of gum on wrapper after 10 min chewing</td>
<td>1.96 g</td>
</tr>
<tr>
<td>Mass of gum after 10 min chewing</td>
<td>1.96 g – 0.22 g = 1.74 g</td>
</tr>
<tr>
<td>Mass of gum on wrapper after 15 min chewing</td>
<td>1.91 g</td>
</tr>
<tr>
<td>Mass of gum after 15 min chewing</td>
<td>1.91 g – 0.22 g = 1.69 g</td>
</tr>
<tr>
<td>Mass lost (unchewed gum – gum after 15 min chewing)</td>
<td>6.56 g – 1.69 g = 4.87 g</td>
</tr>
</tbody>
</table>

**POPCORN**

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Mass (unpopped), g</th>
<th>Mass (popped), g</th>
<th>Mass lost, g</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.55 g</td>
<td>2.29 g</td>
<td>2.55 g – 2.29 g = 0.26 g</td>
</tr>
<tr>
<td>2</td>
<td>2.98 g</td>
<td>2.47 g</td>
<td>2.98 g – 2.47 g = 0.51 g</td>
</tr>
<tr>
<td>3</td>
<td>2.49 g</td>
<td>2.15 g</td>
<td>2.49 g – 2.15 g = 0.34 g</td>
</tr>
</tbody>
</table>

**Calculations**

**BUBBLE GUM**

\[
\text{% Composition of sugar} = \frac{\text{Total mass lost}}{\text{Original mass of gum}} \times 100 = \frac{4.87 \text{ g}}{6.56 \text{ g}} \times 100 = 74.2\%
\]

Draw a graph of mass of gum vs time on the graph to the right:

Explain what the graph shows:

The graph shows that after a certain point the gum stops losing mass because all the sugar has been dissolved.
POPCORN

% Composition of water = \( \frac{\text{Mass lost}}{\text{Mass (unpopped)}} \times 100 \)

Sample 1:

% Composition of water = \( \frac{0.26 \text{ g}}{2.55 \text{ g}} \times 100 \approx 10\% \)

Sample 2:

% Composition of water = \( \frac{0.51 \text{ g}}{2.98 \text{ g}} \times 100 \approx 17\% \)

Sample 3:

% Composition of water = \( \frac{0.34 \text{ g}}{2.49 \text{ g}} \times 100 \approx 14\% \)

Average % of water in your 3 samples:

\( \frac{10\% + 17\% + 14\%}{3} \times 100 \approx 14\% \)

Conclusion

1. If you chewed the gum for five more minutes, what do you think would have happened?
   The gum’s mass would probably remain about the same, since that is what happened between 10 and 15 minutes.

2. What else might have caused a change in the mass of the gum? Answers may vary – below are some possible responses. Other substances besides sugar might have dissolved, which would mean that the mass lost was not just sugar, so the percentage we calculated would be higher than it should be. Also, some of the mass of the chewed gum would come from saliva, which would increase the total mass, making it seem like less sugar dissolved than really did. This would make the percentage we calculated lower than it should be.

3. How does popcorn pop?
   As water that is trapped in the kernel is heated, it turns into a gas. As that gas continues to get hotter, it expands until eventually it pops open the outer layer of the kernel.

4. How might older popcorn kernels differ from the data you collected in this investigation?
   Older kernels might have already lost some of their water content as they dried out over time, so they wouldn’t have as much water left to lose and the % composition of water would be lower.