Handout H02-3. Answer key to Experiment 3. Prove that fire requires oxygen.

1. Describe your favorite/final method. Here are 3 possible demonstrations. No doubt there are others!
   - Make CO₂ in a container by mixing vinegar with baking soda. Insert a burning match into the container. It will be extinguished as soon as it enters the CO₂ layer.
   - Place a candle inside a container. Spoon 10-20 cm³ of baking soda around its base. Pour about 50 mL of vinegar in. Then try to light the candle. Again, the match will be extinguished as soon as it enters the CO₂ layer.
   - Place a candle on the metal tray. Make CO₂ in a container. After the froth settles a bit, pour the CO₂ from the container over the candle – without pouring out any of the liquid that has formed at the bottom of the container. (This feels a little bit like pantomime, since the CO₂ is invisible.) The CO₂ will put out the flame.

2. Record all safety issues that arose and how you addressed them. These could include:
   - Because heat rises, it is best to use a long fireplace match to try to light a candle inside the container.
   - Should you reach your hand into a container that contains a burning candle? You could try the oven mitt, but it could burn. You can tilt the container, but your CO₂ will pour out.
   - The flame can get long (and hot) on the long fireplace match. Don’t hesitate to blow out the match and try again. You might use the oven mitt to hold the match.

3. Record one experimental approach you tried that did not work as well as your “final” approach.

4. Consider the molecular weights of CO₂ and O₂ and the Fire Triangle to explain how your demonstration proves that fire requires oxygen.

   After the chemical reaction is complete, the container contains CO₂ rather than O₂. The CO₂ stays on the bottom of the container because it is heavier than O₂, as we can see from this calculation of the molecular weights of the two compounds:

<table>
<thead>
<tr>
<th>Element</th>
<th>Atomic weight</th>
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<tbody>
<tr>
<td>Carbon (C)</td>
<td>12 g</td>
</tr>
<tr>
<td>Oxygen (O)</td>
<td>16 g</td>
</tr>
</tbody>
</table>
   
   A mole of CO₂ weighs 12 g + 2 * 16 g = 44 g
   A mole of O₂ weighs 2 * 16 g = 32 g

   Fires cannot burn in this oxygen-deprived environment.