Experiment 20 – Reactivity of various alkyl halides in Sn1 and Sn2 - Notes.

![Chemical structures of halides](image)

<table>
<thead>
<tr>
<th>Compound</th>
<th>FW (g/mol)</th>
<th>mp (°C)</th>
<th>bp (°C)</th>
<th>d (g/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 2-chlorobutane</td>
<td>92.57</td>
<td>-140</td>
<td>68-70</td>
<td>0.8700</td>
</tr>
<tr>
<td>2) 2-bromobutane</td>
<td>137.02</td>
<td>-112</td>
<td>91</td>
<td>1.2500</td>
</tr>
<tr>
<td>3) 1-chlorobutane</td>
<td>92.57</td>
<td>-123</td>
<td>77-78</td>
<td>0.8800</td>
</tr>
<tr>
<td>4) 1-bromobutane</td>
<td>137.02</td>
<td>-112</td>
<td>100-104</td>
<td>1.2700</td>
</tr>
<tr>
<td>5) 2-chloro-2-methylpropane</td>
<td>92.57</td>
<td>-25</td>
<td>51-52</td>
<td>0.8500</td>
</tr>
<tr>
<td>8) bromobenzene</td>
<td>157.01</td>
<td>-31</td>
<td>156</td>
<td>1.4900</td>
</tr>
<tr>
<td>9) bromocyclohexane</td>
<td>163.06</td>
<td>na</td>
<td>166-167</td>
<td>1.3200</td>
</tr>
<tr>
<td>10) bromocyclopentane</td>
<td>149.03</td>
<td>na</td>
<td>137-139</td>
<td>1.3900</td>
</tr>
</tbody>
</table>

NOTE: We will NOT be using halides 6 (crotyl chloride) and 7 (benzyl chloride) as they are potent lachrymators.

NOTE: There are specially labeled waste containers for Sn1 waste and for Sn2 waste.

NOTE: Have students perform simultaneous Sn1 and Sn2 on ONE HALIDE AT A TIME!!!!!!
This will avoid a lot of confusion, and hopefully, avoid contamination of the standards. They will still have sufficient time to complete the lab.

NOTE: Have students wear gloves. Alkyl halides are fairly toxic. The alkyl iodide products formed in the Sn2 are a bit more toxic than the precursors (better leaving group, hint, hint).
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Standard Sn2 procedure.

1. In a clean dry test tube, add 2 mL of the 15% NaI/acetone solution.
2. Add 4 drops of ONE of the halides from the table above.
3. Shake (or carefully swirl) the contents of the test tube to ensure proper mixing of the reagents.
4. Note the time needed to form a precipitate or for the mixture to become cloudy.
5. If there is no precipitate or cloudiness after 5 minutes, place the test tube in a 50 °C (Acetone has a boiling point of 56 °C) water bath for 1 MINUTE, then cool to room temperature.
6. Note whether a precipitate or cloudiness formed.
7. Record results in table format.

Standard Sn1 procedure.

1. In a clean dry test tube, add 2 mL of the AgNO₃/EtOH solution.
2. Add 4 drops of ONE of the halides from the table above.
3. Shake (or carefully swirl) the contents of the test tube to ensure proper mixing of the reagents.
4. Note the time needed to form a precipitate or for the mixture to become cloudy.
5. If there is no precipitate or cloudiness after 5 minutes, place the test tube in a 100 °C water bath for about 1 MINUTE, then cool to room temperature.
6. Note whether a precipitate or cloudiness formed.
7. Record results in table format.

TA’s – In each set of hoods, make sure there is one water bath set at 50 °C (for the Sn2), and another water bath set at about 100 °C (for the Sn1).

REPORT:

1. Record your results in the Sn1 and Sn2 in table format, indicate the time for reaction to occur without heating, or if reaction required heating, or if no reaction was observed.
2. List the halides tested in reactivity order in both the Sn1 and Sn2.
3. Comparing the primary halides 3) and 4), was there a difference in reactivity in the Sn2? If so, why?
4. Comparing the secondary bromides 2), 9), and 10), was there a difference in reactivity in the Sn2? If so, why? [consider the 3-D structures of the secondary bromides 2), 9), and 10), and think about the ease of “backside attack”. Making a model may help in visualization.].
5. Explain the difference in reactivity of alkyl chlorides 1), 3), and 5) in the Sn1 reaction.
6. You might not observe a significant difference in the reactivity of the secondary bromides 2), 9), and 10) in the Sn1 reaction (due to the inexact measurements of the experiment). However, if you do, how would you account for this difference? [think about the geometry of a secondary carbocation].
7. Why did halide 8) not react in either the Sn1 or Sn2?