CHEM1611 Worksheet 8 – Answers to Critical Thinking Questions

The worksheets are available in the tutorials and form an integral part of the learning outcomes and experience for this unit.

Model 1: Addition to a Carbonyl

1. See below.

   ![Reaction](image1)

   - (i) LiAlH\(_4\)
   - (ii) H\(^+\)/H\(_2\)O

   ![Reaction](image2)

   - (i) CH\(_3\)CH\(_2\)MgBr
   - (ii) H\(^+\)/H\(_2\)O

2. LiAlH\(_4\) will reduce a carboxylic acid to the carbonyl level. The carbonyl will also be reduced. The overall reaction therefore results in reduction all the way to the alcohol:

   ![Reaction](image3)

3. See below.

   ![Reaction](image4)

   - (i) MgBr
   - (ii) H\(^+\)/H\(_2\)O

   ![Reaction](image5)

   - (i) MgBr
   - (ii) H\(^+\)/H\(_2\)O

Extension: Acid would react directly with the Grignard, leading to the formation of the alkane.
Model 2: Alcohol Addition – Water Elimination

1. By protonating the carbonyl, it makes it much more susceptible to attack by nucleophiles. Even a poor nucleophile like water can then attack.

2. In the second step of the reaction, water is acting as a nucleophile. In the third step of the reaction, water is acting as a base.

3. See below.

4. See below.

5. See below.

6. (a) (b)

H₃CO OCH₃

O

O
7. (a) \[
\begin{align*}
\text{β-D-glucopyranose} & \quad \text{hemiacetal} \\
\end{align*}
\]

(b) \[
\begin{align*}
\text{β-D-mannopyranose} & \quad \text{hemiacetal} \\
\end{align*}
\]