CHEM1002 Worksheet 7 – 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.

   ![Chemical structure](image)

   (i) NaBH₄
   (ii) H⁺/H₂O

   ![Chemical structure](image)

   (i) LiBH₄
   (ii) H⁺/H₂O

2. The first product is chiral and a racemic mixture will be produced. The second product is achiral.

**Model 2: Carboxylic Acid Derivatives**

1. See below. The base, B, could be solvent or H₂NCH₃.

   ![Chemical structure](image)

2. Addition of an amine:

   ![Chemical structure](image)

3. An alcohol (with its alkyl group corresponding, as shown above, to the –OR’ group in the ester.)
4. Simple $H^+$ transfer reactions occur:
SUMMARY OF ORGANIC REACTIONS

1. ALKENES: ELECTROPHILIC ADDITION

![Chemical structures and reactions]

2. ALCOHOLS AND ALKYL HALIDES: ELIMINATION

Which product forms predominantly?

![Chemical structures and reactions]

3. ALCOHOLS, AMINES AND ALKYL HALIDES: NUCLEOPHILIC SUBSTITUTION

![Chemical structures and reactions]
3. NUCLEOPHILIC SUBSTITUTION (Continued)

Na or NaH

\[ 	ext{H}_2\text{C} \rightarrow \text{O}^- \]

3.8

\[ \text{Br} \rightarrow \text{O}^- \]

3.9

H\text{C} \rightarrow \text{I}

3.10

4. ALCOHOLS, ALDEHYDES AND KETONES: OXIDATION

\[ \text{CH}_3\text{OH} \rightarrow \text{[O]} \]

4.1

\[ \text{[O]} \rightarrow \text{CH}_3\text{COOH} \]

4.2

\[ \text{[O]} \rightarrow \text{CH}_3\text{COCH}_3 \]

4.3

[O] is commonly Cr\text{O}_7^{2-} / \text{H}^+

5. CARBOXYLIC ACID DERIVATIVES: NUCLEOPHILIC SUBSTITUTION

With Acids:

\[ \text{CH}_3\text{COOH} \rightarrow \text{SOCl}_2 \rightarrow \text{CH}_3\text{COCl} \]

5.1

\[ \text{H}_2\text{N} \rightarrow \text{CH}_3\text{CONH}_2 \]

5.2

\[ \text{CH}_3\text{OH} \rightarrow \text{CH}_3\text{OCH}_3 \]

5.3

6. CARBOXYLIC ACIDS AND AMINES: ACID/BASE PROPERTIES

Acids:

\[ \text{CH}_3\text{COOH} \rightarrow \text{OH}^- \rightarrow \text{CH}_3\text{COO}^- \]

6.1

Acids:

\[ \text{CH}_3\text{NH}_2 \rightarrow \text{H}^+ / \text{H}_2\text{O} \rightarrow \text{CH}_3\text{NH}_3^+ \]

6.2