CHEM1611 Worksheet 6 – 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: Polar Reactions

1. 

The polarity of the bonds in the molecule at the end are so large that it is sometimes considered as ionic, CH$_3$·Mg$^2+$ Br$^-$. 

2. It is almost always $\delta^+$. 

3. 

4. Four (as always) 

5. 

6. See Q3 and Q5. 

Model 2: Nucleophilic Substitution

1. A new bond is forming between this C atom and the attacking O atom, using the lone pair on this O atom. At the same time, the bond between this C atom and the Cl is breaking. The attack from the O atom inverts the configuration at the C atom. 

2. See below. 

3. $S =$ substitution, $N =$ nucleophilic, “1” = unimolecular (key or rate determining step involves 1 molecule) and “2” = biimolecular (key or rate determining step involves 2 molecules).
4. $S_N2$ is disfavoured if the C atom being attacked is very crowded. In the first example, the C being attacked is a primary carbon (attached to 2H and 1C) so $S_N2$ is possible. In the second example, the carbon being attacked is a tertiary carbon (attached to 3C) and so is more crowded. $S_N2$ is less likely.

$S_N1$ is favoured when the positive charge in the intermediate can be stabilised. In the first example, the positive charge would be on a primary carbon so would be unstable and difficult to form so $S_N1$ is unlikely. In the second example, the positive charge will be on a tertiary carbon so will be more stable and $S_N1$ is possible.

Overall: the primary alkyl halide reacts via $S_N2$ and the second alkyl halide reacts via $S_N1$.

**Model 3: Using Grignard Reagents**

1. See below.

   ![Diagram](image1)

2. See below.

   (a) ![Diagram](image2)

   (b) ![Diagram](image3)

3. See above.

4. See below.

   ![Diagram](image4)

5. See above.
6. The Grignard will attack $\text{H}^+$ instead of the $\delta^+$ carbon atom in the electrophile. This will result in the formation of an alkane. An example is shown below. The Grignard reagent is wasted and none of the desired product is formed.

![Reaction Diagram]

**Model 4: Elimination Reactions**

1. See below.

![Elimination Reaction 1 Diagram]

2. $\text{H}_2\text{O}$ is a better leaving group than $\text{OH}^-$.  
3. Catalyst.  
4. See below.

![Elimination Reaction 2 Diagram]

5. See above.  
6. See below.

![Elimination Reaction 3 Diagram]

   $1 =$ one molecule involved in key reaction step. $2 =$ two molecules involved in key reaction step.