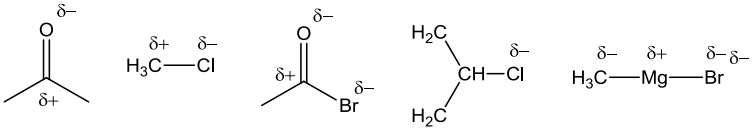
CHEM1611 Worksheet 6 – Answers to Critical Thinking Questions

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. .

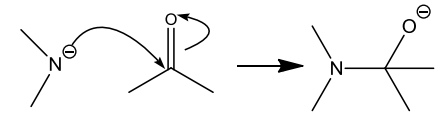


large large large large very large

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^-.

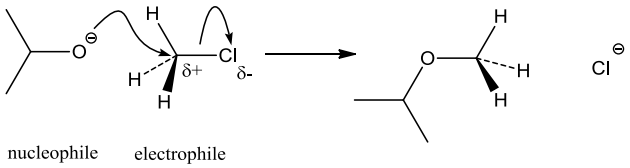
2. It is almost always δ^+.

3.



nucleophile electrophile

4. Four (as always)
5.



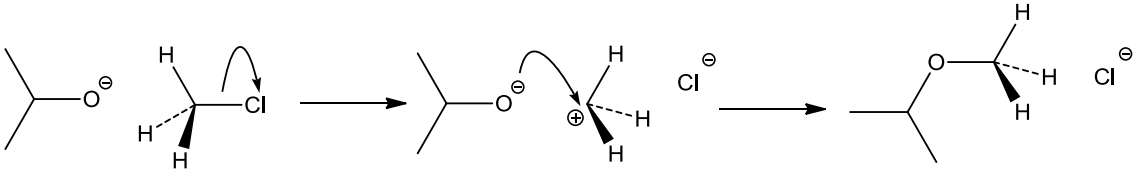
nucleophile electrophile

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).

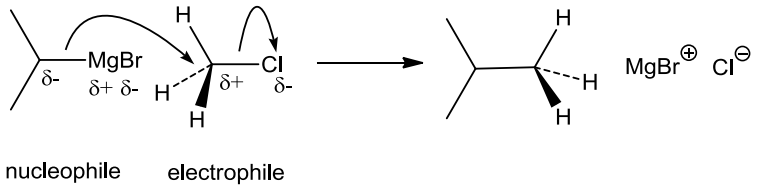
4. S_N2 is disfavoured if the C atom being attacked is very crowded. In the first example, the C being attacked is a primary carbon (attached to 2H and 1C) so S_N2 is possible. In the second example, the carbon being attacked is a tertiary carbon (attached to 3C) and so is more crowded. S_N2 is less 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.

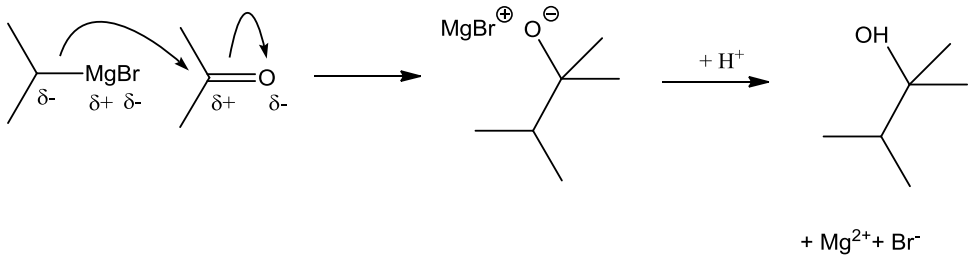
Model 3: Using Grignard Reagents

1. See below.

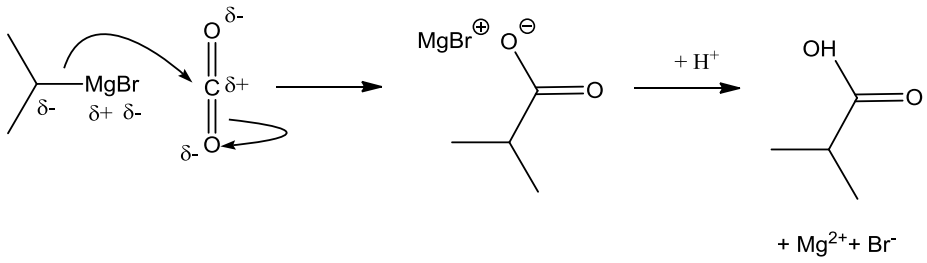


2. See below.

(a)

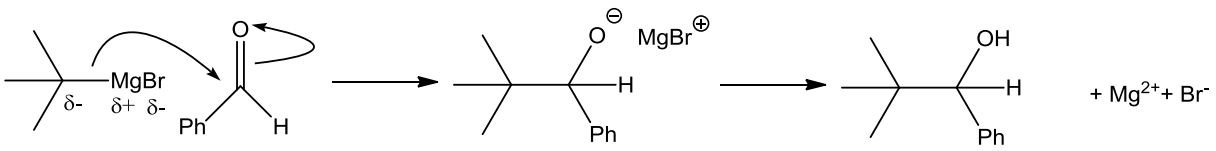


(b)



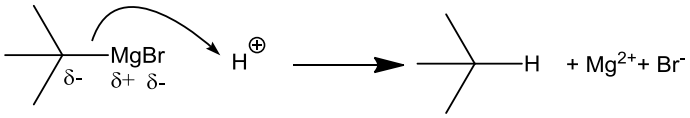
3. See above.

4. See below.



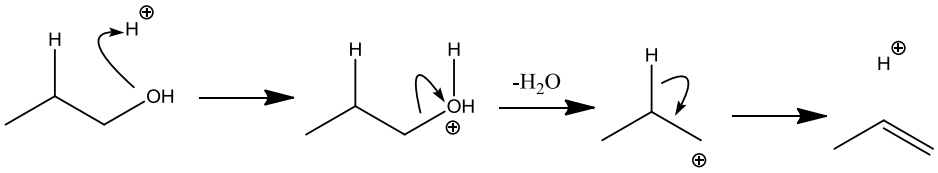
5. See above.

6. The Grignard will attack H^+ instead of the δ^+ 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.



Model 4: Elimination Reactions

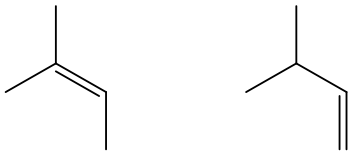
1. See below.



2. H_2O is a better leaving group than OH^-.

3. Catalyst.

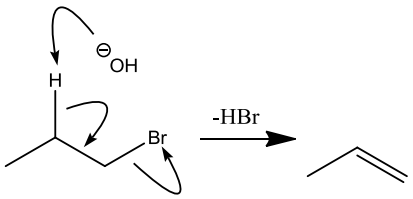
4. See below.



major minor

5. See above.

6. See below.



7. E = elimination. S_N = nucleophilic substitution.
1 = one molecule involved in key reaction step. 2 = two molecules involved in key reaction step.