Chemistry 260 Summer 2025

E11: The Grignard Reaction

**<<This report will be completed as an “in-lab assignment” that you will work on and hand in at the end of the period. You can (and should!) do some of the work (e.g., the 1H and 13C NMR and questions that relate to them) in advance.>>**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Section:\_\_\_\_\_\_\_\_\_\_\_Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Observations (1 marks)**

**Reagents and Products Tables (1 marks; 0.5 marks each)**

Table 1. Reagents for the Grignard reaction

| Compound | MW (g/mol) | Used | mmol | Physical and Safety Data |
| --- | --- | --- | --- | --- |
| Magnesium  | 24.31 |  |  | Flammable; irritant. |
| Benzyl chloride | 126.58 |  |  | Serious eye irritant, lachrymator, toxic, Bp 177-181 °C. Handle with gloves in fumehood! |
| Iodine | 253.81 | one speck | N/A | Highly toxic; corrosive. Mp 113 °C. |
| Acetone | 58.08 |  |  | Highly flammable; irritant to eyes. Bp 56 °C; density 0.872 g/mL |
| 3 M hydrochloric acid | N/A | 30 mL | excess | Highly toxic; corrosive.  |
| Ascorbic acid | 176.12 |  | wash | Irritant. |

Table 2. Product of the Grignard reaction

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Compound | Physical Description | MW (g/mol) | Amount Isolated | mmol | % yield |
| 2-methyl-1-phenyl-2-propanol |  | 150.22 |  |  |  |

**Results**

**Percent Yield Calculation: (1 mark)**

**Results of IR Analysis: (1 mark)**

Table 3. **KEY** signals in the IR of 2-methyl-1-phenyl-2-propanol (only list key peaks used for identification, you may not need all of the rows of this table)

|  |  |  |
| --- | --- | --- |
| Wavenumber (cm-1)  | Strength (s/m/w) | Assignment and/or Comment |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Table 4. 13C/DEPT NMR Data (3 marks)**

|  |  |  |
| --- | --- | --- |
| (ppm) | DEPT-135 | Assignment and/or Comment |
| phase | inference |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| **77.1 (t)** |  |  |  |
|  |  |  |  |
|  |  |  |  |
| **38.2** | **↓** | CH2 | Wurtz coupling product (CH2 group) |
|  |  |  |  |

Labelled structure (add your own labels to match your table):



**Table 5. 1H NMR Data: (2 marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| chemical shift, δ (ppm) | multiplicity | coupling constant (Hz) | integration | assignment |
| **actual** | **relative** |
| 7.32 – 7.15 | multiplet | N/A | 5.53 |  |  |
| 2.75 |  |  | 2.00 |  |  |
| 1.32 |  |  | 1.19 |  |  |
| 1.21 |  |  | 6.33 |  |  |

Labelled structure (add your own labels to match your table):



**In-lab Assignment Questions:**

Comment on the success/failure of the reaction. Does your IR indicate that you have made the desired product? Is there any evidence of starting material? (**1 marks)**

The NMR spectra in the manual show evidence of a small amount of the Wurtz coupling product from a side reaction. Draw the structure of the Wurtz coupling product. Can you tell from your IR data whether this compound is present in your reaction? (**2 marks)**

Provide a *brief* justification of how you assigned the peaks in the 13C NMR & DEPT spectra. (**3 marks)**

Would any 2D NMR spectra have been useful in helping to assign the peaks of the 1H or 13C NMR? Why or why not? (**3 marks**)

**Additional Graded Components:**

**Prelab: 1 mark**

**Samples & Clean-up: 1 mark**