1. Predict the major product of the following reactions. (20%, 5% each)

(1)
\[
\text{Ar} + \text{R} \rightarrow \text{Product}
\]

(2)
\[
\text{Ar} + \text{H}_2 \text{O} \rightarrow \text{Product}
\]

(3)
\[
\text{Ar} + \text{H}_2 \text{O} \rightarrow \text{Product}
\]

(4)
\[
\text{Ar} + \text{H}_2 \text{O} \rightarrow \text{Product}
\]

2. Drawing and compared the energy difference of cyclohexane in the following conformation states. (20%, 5% each)

(1) chair (2) boat (3) twist (4) half-chair.

3. Please provide the structures for A - E. (20%, 4% each)

4. Select the best answer for the following questions. (20%, 4% each)

(1) What is the correct name of the following compound?

(A) Methyl benzyl ether (B) 4-Methoxybenzene (C) Anisole (D) 4-Hydroxyanisole

(2) Which would be the structure of the product for the following Friedel-Crafts reaction?

(3) Which is aromatic of the following species?

(A) (B) (C) (D)

(4) What would be the major product from the addition of cyclopentene with Br₂/CCl₄?

(A) trans-1,2-dibromocyclopentane (B) cis-1,2-dibromocyclopentane (C) trans-1,3-dibromocyclopentane (D) cis-1,4-dibromocyclopentane

(5) Which of the following compound has a sharp IR absorption at 1610 cm⁻¹?

(A) CH₃COCH₃ (B) CH₃CH₂OH (C) CH₃CH₂OCH₂CH₃ (D) trans-CH₃CH=CHCH₃

5. Predict the organic product and propose a mechanism for each of the following reactions. (20%, 10% each)

(A) PhCH₂CH₂OH + Ph₂P=CHCH₃

i) PhLi, -78 °C

ii) t-BuOH

(B) H₂N₂H₂

NaOH / heat