Exam IV
April 24, 2020

Name: ___________________________
Section: _________________________

This exam is a closed book, closed notes.
Calculators and a molecular model set are allowed.
You must show your work in order to receive partial credited.

Question I (14 points): __________________
Question II (22 points): ________________
Question III (48 points): ________________
Question IV (16 points): __________________

Total (out of 100) : ___________________
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Question I. (14 points)
A) Compounds A and B will each undergo an intramolecular Heck reaction, although each compound generates a different product. Draw the product of each reaction and explain why different products are obtained (2 points)

B) Draw the monomers required to make the following alternating copolymer: (2 points)
\[ H \quad Cl \quad H \quad P_h \]
\[ C-C-C-C \]
\[ H \quad Cl \quad H \quad P_h \]

C) Explain the following result: (2 points)
\[ NH_2 \quad Fuming H_2SO_4 \quad NH_2 \]
\[ -NH_2 \rightarrow o/p director \]
\[ -N_3 \rightarrow m director. \]

D) Identify which of the following monomers would be most reactive toward cationic polymerization: (2 points)

E) Identify the number of chiral centers in the following structure. (2 points)

2 chiral centers.

F) Determine whether the following pair of monomers would form chain-growth polymers or step-growth polymers. (2 points)

step-growth
G) Cationic polymerization of para-methoxystrene occurs much more rapidly than cationic polymerization of meta-methoxystrene. Explain this difference in rate (2 points)

MeO- activates ortho/para positions.

Question II. Reactions: provide major product or reagents for the following reactions, making sure to consider the regio- and stereo-chemical outcome (2 points each, 22 points total)

\[
\begin{align*}
\text{[H+]}, \text{H2O} & \quad \text{[Pd]}, \text{Base} \\
\text{OH} & \quad \text{Cl2Cl} \\
\text{H2N} & \quad \text{H2SO4} \\
\text{1} & \quad \text{excess MeI} \\
\text{Ag2O}, \text{H2O, heat} \\
\text{catalytic H2SO4} & \quad \text{NaBH3CN} \\
\text{NaNO2}, \text{HCl} & \quad \text{N=0}
\end{align*}
\]
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1) excess MeI
2) Ag₂O, H₂O, heat

\[
\begin{align*}
\text{O}_2\text{N} & \quad \quad \text{O}_2\text{N} \\
\text{Ph} & \quad \quad \text{Ph} \\
\text{Me} & \quad \quad \text{Me} \\
\text{NH}_2 & \quad \quad \text{NH}_2 \\
\text{CH}_2 & \quad \quad \text{CH}_2
\end{align*}
\]

-[Pd], Base

\[
\begin{align*}
\text{O}_2\text{N} & \quad \quad \text{O}_2\text{N} \\
\text{Ph} & \quad \quad \text{Ph} \\
\text{CH}_2 & \quad \quad \text{CH}_2
\end{align*}
\]

\[
\begin{align*}
\text{HO} & \quad \quad \text{NH}_2 \\
\text{Ph} & \quad \quad \text{Me} \\
\text{N}_2\text{H}_5 & \quad \quad \text{Me} \\
\text{NH}_2 & \quad \quad \text{NH}_2 \\
\text{CH}_2 & \quad \quad \text{CH}_2
\end{align*}
\]

NaNO₂
HCl

1) cat. HA
2) NaBH₃CN

Question III. Multiple step synthesis. Draw the product of every step. (48 points total)

a)

\[
\begin{align*}
\text{Cl} & \quad \quad \text{Br} \\
\text{NaM}_2 & \quad \quad \text{Na}_2\text{M}_2
\end{align*}
\]

\[
\begin{align*}
\text{O} & \quad \quad \text{Br} \\
\text{CuBr} & \quad \quad \text{CuBr}
\end{align*}
\]

b)

\[
\begin{align*}
\text{NH}_2 & \quad \quad \text{NO}_2 \\
\text{Cl} & \quad \quad \text{Cl}
\end{align*}
\]

\[
\begin{align*}
\text{NO}_2 & \quad \quad \text{Cl} \\
\text{H}_2\text{SO}_4 \quad \quad \text{H}_2\text{SO}_4
\end{align*}
\]

\[
\begin{align*}
\text{O} & \quad \quad \text{O} \\
\text{N}_2\text{H}_5 & \quad \quad \text{N}_2\text{H}_5
\end{align*}
\]

\[
\begin{align*}
\text{O} & \quad \quad \text{O} \\
\text{N}_2\text{H}_5 & \quad \quad \text{N}_2\text{H}_5
\end{align*}
\]

\[
\begin{align*}
\text{O} & \quad \quad \text{O} \\
\text{N}_2\text{H}_5 & \quad \quad \text{N}_2\text{H}_5
\end{align*}
\]

Diluted H₂SO₄
NaOH
e) Complete the synthesis: (9 points)
Question IV. Mechanism (16 points total)

a) Propose a plausible mechanism for the following transformation: (4 points)

b) Propose a plausible mechanism for the following transformation: (4 points)

c) Give an example of Curtius rearrangement and detailed electron pushing mechanism: (4 points)
Gabriel amine synthesis:

[Chemical diagrams]