Multiple Choice Questions.  60 points Select the best answer to each of the questions.

1. In the following separation choose the location of the carboxylic acid.
2. Choose the order that has the following compounds correctly arranged with respect to increasing basicity.

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

\[\text{i} < \text{iii} < \text{ii} \quad \text{increasing basicity}\]

3. Choose the reaction(s) that would not give aniline.

\[\begin{align*}
\text{i} & \quad \text{LiAlH}_4 & & \text{H}_2\text{O} & & \text{aniline} \\
\text{N}_3 & & \text{aniline} & & \text{aniline} \\
\end{align*}\]

\[\begin{align*}
\text{A. i} & & \text{B. ii} & & \text{C. iii} & & \text{D. i and ii} & & \text{E. ii and iii}
\end{align*}\]

4. Using benzene as the reactant, choose the reaction(s) that would not give m-chlorobromobenzene.

\[\begin{align*}
\text{i} & \quad \text{Cl}_2/\text{FeCl}_3 & & \text{Br}_2/\text{FeBr}_3 & & \text{Br} & & \text{Cl} \\
\text{Benzene} & & \text{Cl} & & \text{Br} \\
\end{align*}\]

\[\begin{align*}
\text{A. i} & & \text{B. ii} & & \text{C. iii} & & \text{D. i and ii} & & \text{E. ii and iii}
\end{align*}\]

5. Choose the order that has the following carbonyl groups correctly arranged with respect to increasing resonance stabilization.

\[\begin{align*}
\text{C} & & \text{S} & & \text{N} & & \text{O} \\
\text{CH}_3 & & \text{CH}_3 & & \text{CH}_3 & & \text{CH}_3 \\
\end{align*}\]

\[\begin{align*}
\text{i} & & \text{ii} & & \text{iii} \\
\end{align*}\]

\[\begin{align*}
\text{A. i} & & \text{B. ii} & & \text{C. iii} & & \text{D. i and ii} & & \text{E. ii and iii}
\end{align*}\]
6. Choose those structures consistent with the isoprene rule. That is, which structures have identifiable isoprene units.

A. i B. ii C. iii D. i and iii E. ii and iii

7. Choose the most reasonable cation as a structure for an intermediate in the biosynthesis of limonene from geraniol.

A. i B. ii C. iii D. i and iii E. ii and iii

8. Choose the reaction type that you would not anticipate for NADPH.

A. i B. ii C. iii D. i and iii E. ii and iii

9. Choose the major product of the following reaction.
10. Choose the electron count for the metal in following transition metal complex.

\[
\text{Rh}^\text{III} \overset{\text{H}}{\text{P}} \overset{\text{C}}{\text{C}} \overset{\text{O}}{\text{P} (\ce{C_6H_5})_3}
\]

A = 14  B = 15  C = 16  D = 17  E = 18

11. Choose the major product of the following reaction.

\[
\text{Ru} \overset{\text{olefin metathesis}}{\rightarrow}
\]

12. Choose the major product of the following reaction sequence.

13. Give the structure the major product of the following reactions.

(a) \[
\text{Br} + \overset{\text{Pd}^*}{\text{Ph}} \rightarrow \overset{\text{Ph}}{\text{Ph}}
\]

(b) \[
\overset{\text{OH}}{\text{Br}} \overset{\text{Ph}}{\text{Ph}} \overset{\text{OCH}_3}{\text{OCH}_3} \overset{\text{Br}^\text{3}}{\text{C}_{13}\text{H}_{14}\text{O}} \rightarrow \overset{\text{Ph}}{\text{Ph}} + \overset{\text{CO}_2}{\text{OCH}_3}
\]
14. Give the reactants and reagents that could be used to perform the following transformation.

(a)

(b) and any other compounds containing 4 carbon atoms or less

15. Give the structures for compounds A-D.

16. Using the curved arrow formalism show how the isomerism of isopentenyl pyrophosphate to dimethylallyl pyrophosphate can occur and their reaction to give geranyl pyrophosphate in the biosynthesis of cholesterol.