In various ducks special fatty acids are produced to make special water resistant esters. One such acid is the compound, 2,4,6-trimethylnonanoic acid.

The biosynthetic pathway for 2,4,6-trimethylnonanoic acid is thought to be similar to the normal FAS fatty acid synthase pathway discussed in class, but a different primer compound is used and a different compound is used as the extenders.

1. Which of the above compounds is used as the primer compound in the biosynthesis? B
2. Which of the above compounds is used as the extender compound for biosynthesis? E
3. How many moles of NADPH would be needed for the biosynthesis of 2,4,6-trimethylnonanoic acid? C

Use the following compounds to answer the next two questions.

4. What is the product of the following reaction? A

5. What is the product of the following reaction? D
A student tried to synthesize phenyl benzoate, but the reaction did not work very well and instead of pure product the student got a mixture of three compounds. Dr. Katsamanis suggested the following separation scheme, but he did not tell the student which compound would be in each of the five flasks.

6. Which flask contains the phenol? **D**
7. Which flask contains the benzoic acid? **B**
8. Which flask contains the ester? **E**

___________________________________________________________

Use the following compounds to answer the next two questions.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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9. What is the main product of the following reaction sequence? **A**

10. What is the main product of the following reaction sequence? **B**
11. Predict the product of the following reaction.

\[ \text{O} \equiv \text{C} \equiv \text{O} + \text{CH}_2=\text{CH}_2 \xrightarrow{\text{NaOCH}_3, \text{HOCH}_2} \]

12. Predict the product of the following reaction.

\[ \text{PhCH}_2 \text{CO}_2 \text{H} + \text{HCHO} \xrightarrow{\text{HCl}} \]

13. Predict the product of the following reaction.

\[ \text{CH}_3 \]

\[ \text{CH}_3 \text{NCH}_3 \]

\[ \text{CH}_3 \text{NCH}_3 \]

\[ \text{CH}_3 \text{NCH}_3 \]

\[ \text{CH}_3 \text{NCH}_3 \]

\[ \text{CH}_3 \text{NCH}_3 \]

\[ \text{CH}_3 \text{NCH}_3 \]
14. Predict the product of the following aldol condensation.

\[ 2 \text{ALD} \xrightarrow{\text{2OH}} \text{H}_2\text{O} \]

15. The following reaction is called the Eschweiler-Clarke methylation reaction. It is a general method for making tertiary dimethyl amines from a primary amine.

\[ R\text{NH}_2 + \text{H}_2\text{CO} \xrightarrow{\text{excess}} \text{HCCH}_3 \text{NCH}_3 + 2\text{H}_2\text{O} + 2\text{CO}_2 \]

*Eschweiler-Clarke Methylation Reaction*

The two methyls are added using two identical successive steps. Write a curved arrow mechanism for the first step using isopropyl amine as the starting amine as shown below. (8 pts)
16. The following compound is an intermediate in a synthesis of the appetite suppressant Subytramine. Give a synthesis starting with 2-(4-chlorophenyl)acetonitrile and other compounds of your choice. (10 pts)

\[
\begin{align*}
\text{Cl} & \quad \text{C} = \text{N} \\
\text{LDA} & \quad \text{Br} & \quad \text{Br} & \quad \text{LDA} & \quad \text{BrMg} & \quad \overset{H^+}{\text{Cl}}
\end{align*}
\]

17. The intermediate compound in the previous question is converted in to Subytramine via the following reaction sequence. Give the structure of Subytramine. (Hint: read question 15 before doing this problem) (6 pts)

\[
\begin{align*}
\text{Cl} & \quad \text{C} & \quad \text{O} & \quad \text{NH}_3 \\
\text{Cl} & \quad \text{C}_{15} \text{H}_{19} \text{ClO} & \quad \text{HCHO} & \quad \text{HCHO} & \quad \overset{H\text{H}}{\text{excess}} & \quad \overset{H\text{H}}{\text{excess}} & \quad \overset{\text{Subytramine}}{\text{C}_{17} \text{H}_{28} \text{ClN}}
\end{align*}
\]

18. The compound resveratrol, C\textsubscript{14}H\textsubscript{12}O\textsubscript{3}, is a compound produced by several plants when under attack by various pathogens. Its biosynthetic pathway starts with the synthesis of the intermediate compound shown below.

This intermediate compound then undergoes the following enzyme directed reaction sequence to give resveratrol.

a. intramolecular aldol reaction
b. thio ester hydrolysis
c. decarboxylation
d. dehydration
e. two keto-enol tautomerizations

Draw the structure of resveratrol, C\textsubscript{14}H\textsubscript{12}O\textsubscript{3}. (8 pts)
19. The following reaction is named the Schmidt reaction. Write a curved arrow mechanism. (10 pts)

20. Give a synthesis of the compound shown below starting with cyclohexanone and other carbon containing molecules of four carbons or less. (8 pts)