Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Exam 3**

# Part 1: Functional Group Review

1. Identify the functional groups by matching the given structures with the provided options. Write the letter in the box located under each structure. (6 points)

|  |  |  |  |
| --- | --- | --- | --- |
| **A.** Acetal | **F.** Anhydride | **K.** Epoxide | **P.** Lactam |
| **B.** Alcohol | **G.** Amine | **L.** Ester | **Q.** Nitrile |
| **C.** Alkene | **H.** Amide | **M.** Hemiactetal | **R.** Ketone |
| **D.** Aldehyde | **I.** Carboxylic acid | **N.** Imine |  |
| **E.** Alkyne | **J.** Enamine | **O.** Lactone |  |



# Part II. Reagent Review

1. Use the space provided to write or draw the reagent(s) necessary to complete each reaction transformations. (6 points)



|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |

1. Use the space provided to write or draw the reagents necessary to complete each reaction transformations. (6 points)



|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |

1. Use the space provided to write or draw the reagents necessary to complete each reaction transformations. (6 points)



|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |

1. Use the space provided to write or draw the reagents necessary to complete each reaction transformations. (6 points)



|  |  |  |
| --- | --- | --- |
| **A** | **B** | **C** |

# Part III: Reaction Review.

1. Draw the **major** organic product(s) formed in the following reaction transformations. (12 points)









1. Draw the **major** organic product(s) formed in the following reaction transformations. (12 points)









# Part V: Retrosynthesis.

1. Draw the reactants used to produce the following compound by diazonium coupling. (4 points)



1. Draw the reactants used to produce the following compound by reductive amination. (4 points)



1. Draw the reactants used to produce the following compound by Robinson annulation. (4 points)



# Part VI: Spectroscopy Match-up

1. Use the following 1H and 13C NMR spectra to determine the correct compound. Please circle your answer.

 (6 points)





1. Use the following 1H and 13C NMR spectra to determine the correct compound. Please circle your answer.

 (6 points)





# Part VII. Synthesis

1. Draw the intermediates of the following stepwise conversion of p-isobutyl benzaldehyde to the analgesic ibuprofen. (11 points)



**Ibuprofen**

1. Draw the intermediates of the following stepwise conversion. (11 points)

