

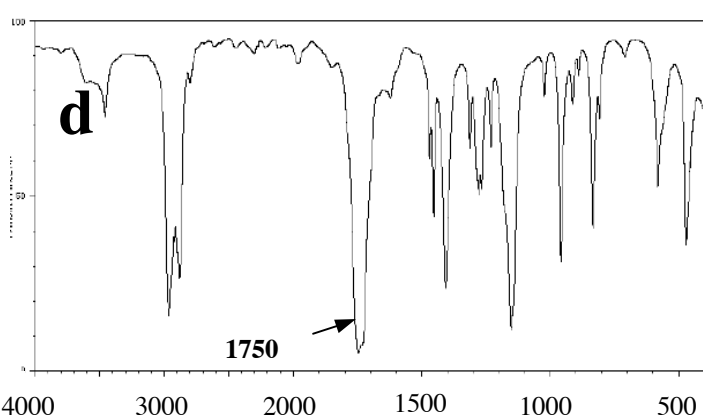
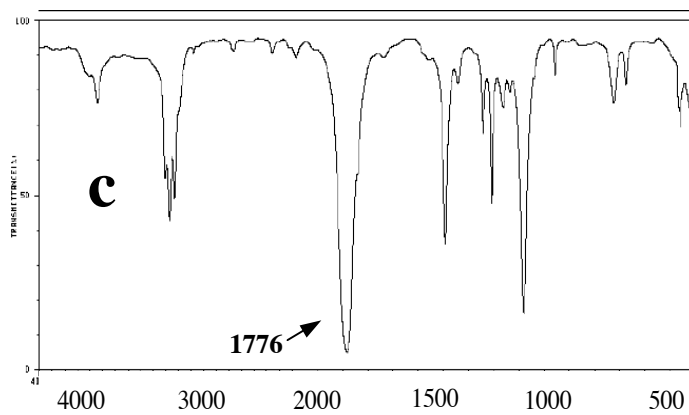
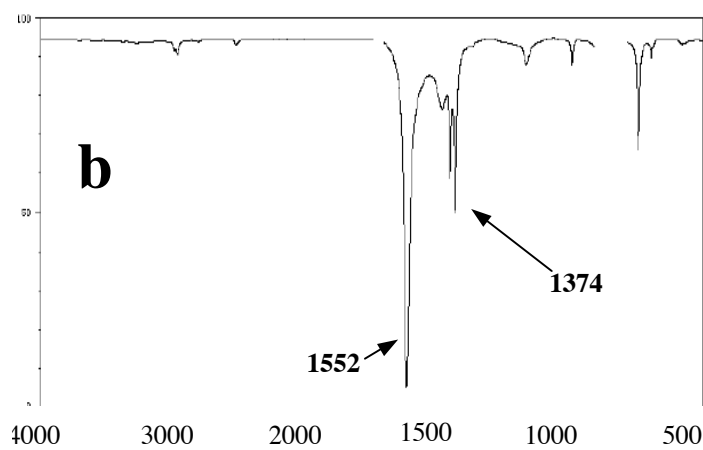
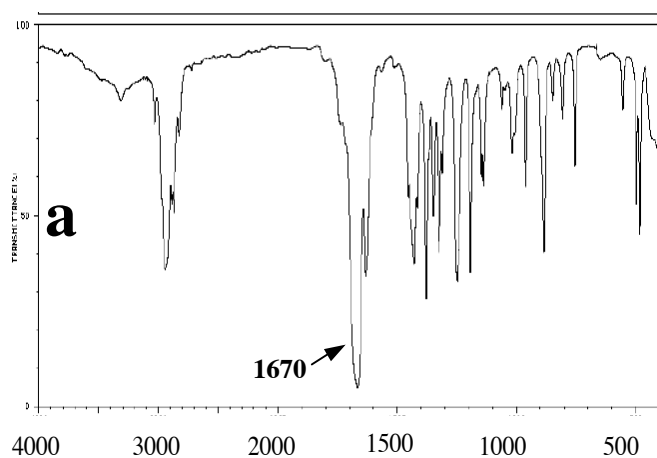
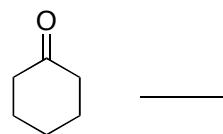
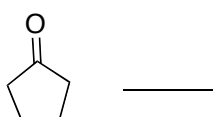
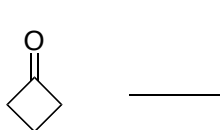
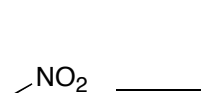
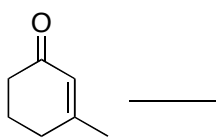
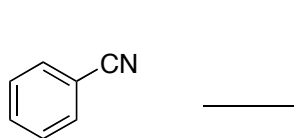
Chem 334, Exam 1  
Professor Fox  
Spring 2009

Your Name\_\_\_\_\_

Your TA's Name\_\_\_\_\_

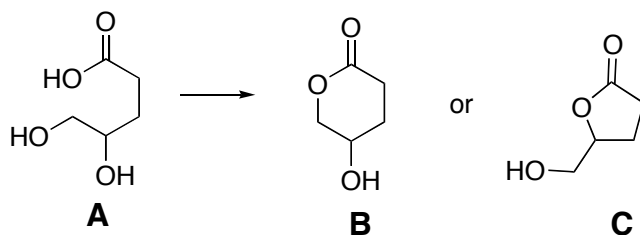
(24 points) (not all compounds have a match)

1. Match the following to their IR spectra



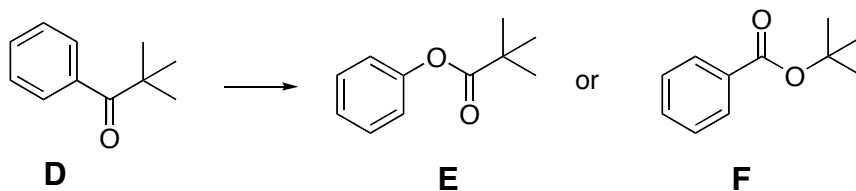
2. Dehydration of **A** could lead to either **B** or **C**. Explain how you would use IR spectroscopy to distinguish these compounds

(12 points)

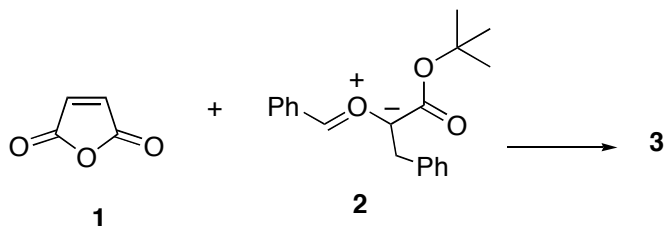


3. Oxidation of **D** could lead to either **E** or **F**. Explain how you would use  $^{13}\text{C}$  NMR to distinguish these compounds.

(12 points)



4. The reaction of compounds **1** and **2** produces compound **3**.



Spectroscopic data for **3**

**IR:** 1866, 1784, 1743  $\text{cm}^{-1}$

**C<sub>24</sub>H<sub>24</sub>O<sub>6</sub>**

**<sup>1</sup>H NMR**

7.34-7.31 (m, 5H)  
 7.27-7.20 (m, 5H)  
 5.33 (d, J=8.6 Hz, 1H)  
 3.79 (d, J=8.9 Hz, 1H)  
 3.71 (dd, J=8.6, 8.9 Hz, 1H)  
 3.31 (d, J=14.1 Hz, 1H)  
 3.21 (d, J=14.1 Hz, 1H)  
 1.44 (s, 9H)

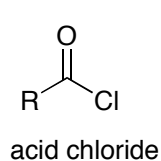
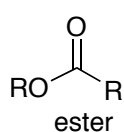
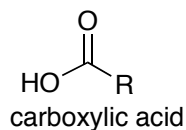
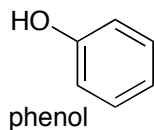
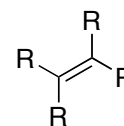
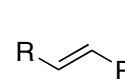
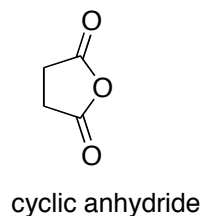
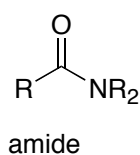
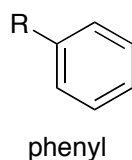
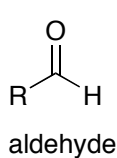
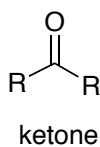
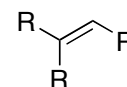
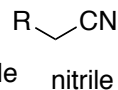
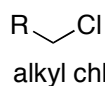
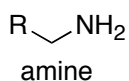
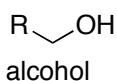
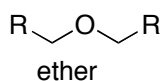
**<sup>13</sup>C NMR**

|                      |                      |
|----------------------|----------------------|
| 168.6 (s)            | 128.5 (d, 2 carbons) |
| 167.4 (s)            | 127.4 (d)            |
| 167.0 (s)            | 126.2 (d)            |
| 135.1 (s)            | 88.9 (s)             |
| 134.5 (s)            | 84.0 (s)             |
| 130.3 (d, 2 carbons) | 82.0 (d)             |
| 129.0 (d, 2 carbons) | 55.2 (d)             |
| 128.6 (d, 2 carbons) | 52.0 (d)             |
|                      | 41.7 (t)             |
|                      | 27.7 (q, 3 carbons)  |

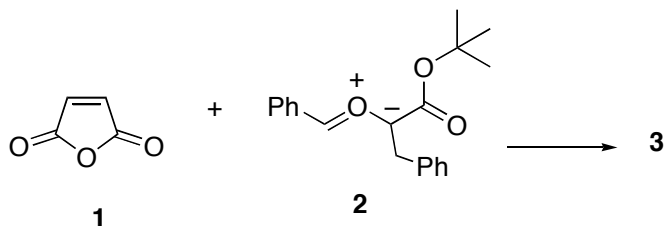
a) Circle the functional group that is associated with

(i) IR: 1866, 1790  $\text{cm}^{-1}$  (8 points)

alkane



4. The reaction of compounds **1** and **2** produces compound **3**.



Spectroscopic data for **3**

**IR:** 1866, 1784, 1743  $\text{cm}^{-1}$

**$\text{C}_{24}\text{H}_{24}\text{O}_6$**

**$^1\text{H}$  NMR**

7.34-7.31 (m, 5H)  
 7.27-7.20 (m, 5H)  
 5.33 (d,  $J=8.6$  Hz, 1H)  
 3.79 (d,  $J=8.9$  Hz, 1H)  
 3.71 (dd,  $J=8.6, 8.9$  Hz, 1H)  
 3.31 (d,  $J=14.1$  Hz, 1H)  
 3.21 (d,  $J=14.1$  Hz, 1H)  
 1.44 (s, 9H)

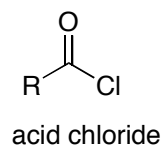
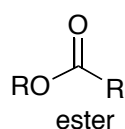
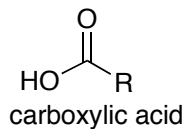
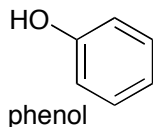
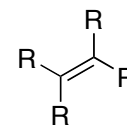
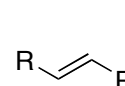
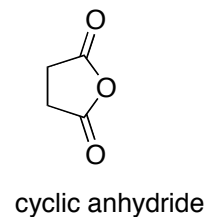
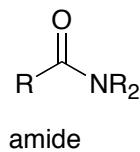
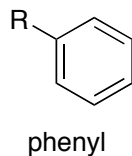
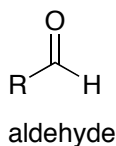
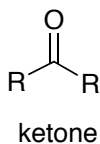
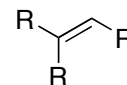
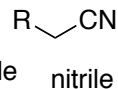
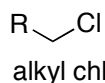
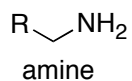
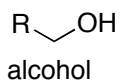
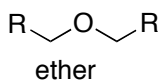
**$^{13}\text{C}$  NMR**

|                      |                      |
|----------------------|----------------------|
| 168.6 (s)            | 128.5 (d, 2 carbons) |
| 167.4 (s)            | 127.4 (d)            |
| 167.0 (s)            | 126.2 (d)            |
| 135.1 (s)            | 88.9 (s)             |
| 134.5 (s)            | 84.0 (s)             |
| 130.3 (d, 2 carbons) | 82.0 (d)             |
| 129.0 (d, 2 carbons) | 55.2 (d)             |
| 128.6 (d, 2 carbons) | 52.0 (d)             |
|                      | 41.7 (t)             |
|                      | 27.7 (q, 3 carbons)  |

b) Circle the functional group that is associated with (8 points)

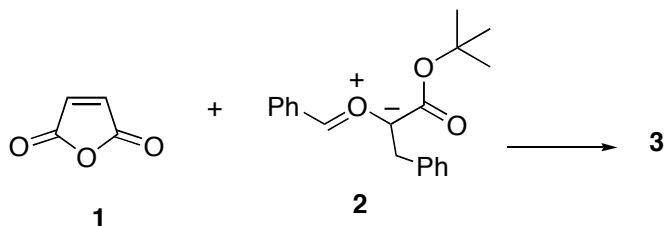
(i) IR: 1743  $\text{cm}^{-1}$

alkane



4. The reaction of compounds **1** and **2** produces compound **3**.

continued



Spectroscopic data for **3**

**IR:** 1866, 1784, 1743  $\text{cm}^{-1}$

**$\text{C}_{24}\text{H}_{24}\text{O}_6$**

**$^1\text{H}$  NMR**

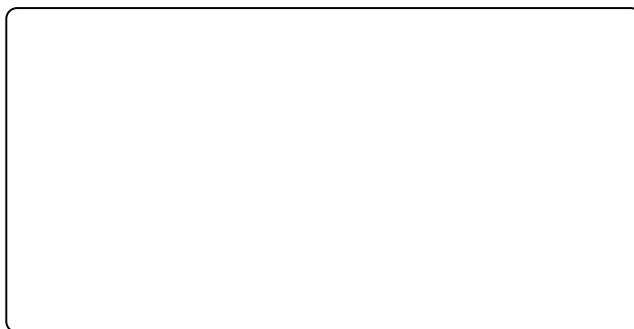
7.34-7.31 (m, 5H)  
 7.27-7.20 (m, 5H)  
 5.33 (d,  $J=8.6$  Hz, 1H)  
 3.79 (d,  $J=8.9$  Hz, 1H)  
 3.71 (dd,  $J=8.6, 8.9$  Hz, 1H)  
 3.31 (d,  $J=14.1$  Hz, 1H)  
 3.21 (d,  $J=14.1$  Hz, 1H)  
 1.44 (s, 9H)

**$^{13}\text{C}$  NMR**

|                      |                      |
|----------------------|----------------------|
| 168.6 (s)            | 128.5 (d, 2 carbons) |
| 167.4 (s)            | 127.4 (d)            |
| 167.0 (s)            | 126.2 (d)            |
| 135.1 (s)            | 88.9 (s)             |
| 134.5 (s)            | 84.0 (s)             |
| 130.3 (d, 2 carbons) | 82.0 (d)             |
| 129.0 (d, 2 carbons) | 55.2 (d)             |
| 128.6 (d, 2 carbons) | 52.0 (d)             |
|                      | 41.7 (t)             |
|                      | 27.7 (q, 3 carbons)  |

c) draw the structure of the product (no partial credit)

(21 points)



d. Assign the following coupling constants: (15 points)

5.33 (d,  $J=8.6$  Hz, 1H)  
 3.79 (d,  $J=8.9$  Hz, 1H)  
 3.71 (dd,  $J=8.6, 8.9$  Hz, 1H)