

**NMR Practice Problem (Part I)**

**Fall 2015**

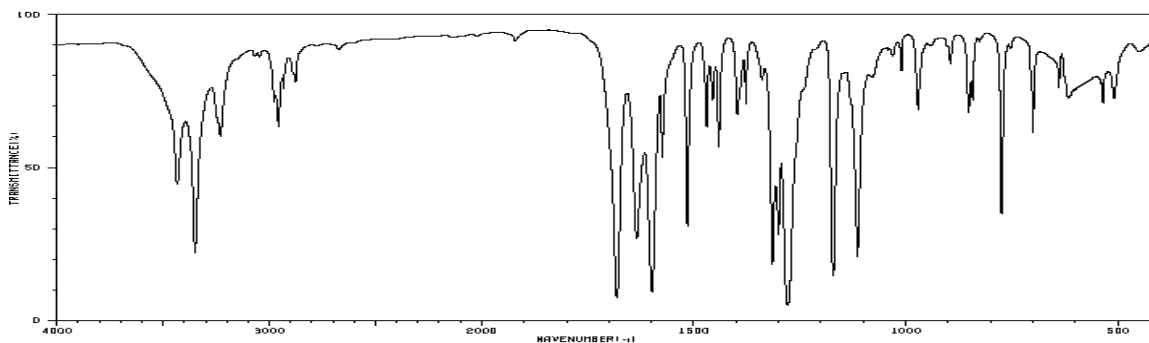
**(Problems from former Chem 30BL finals)**

Fall 2007

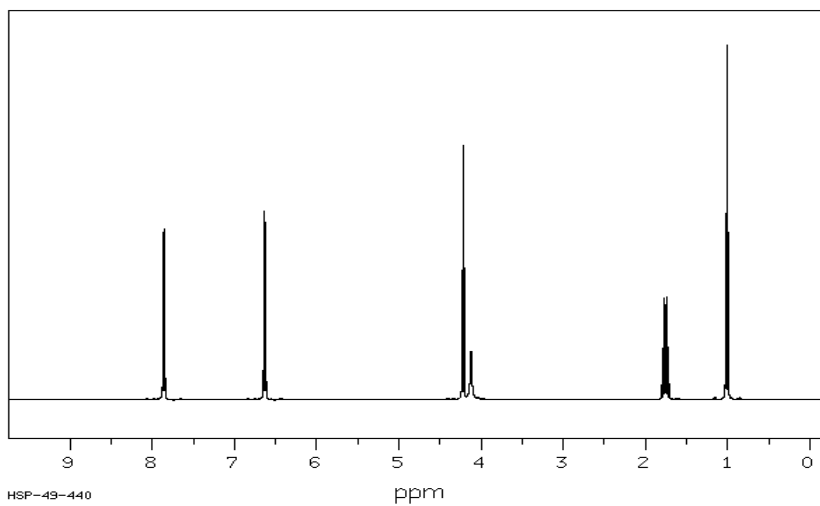
1. Compound **W** has an empirical formula of  $C_{10}H_{13}NO_2$ . Given are the following spectra.

a. Determine the degree of unsaturation for the compound.

b. Assign five pertinent peaks in the infrared spectrum.

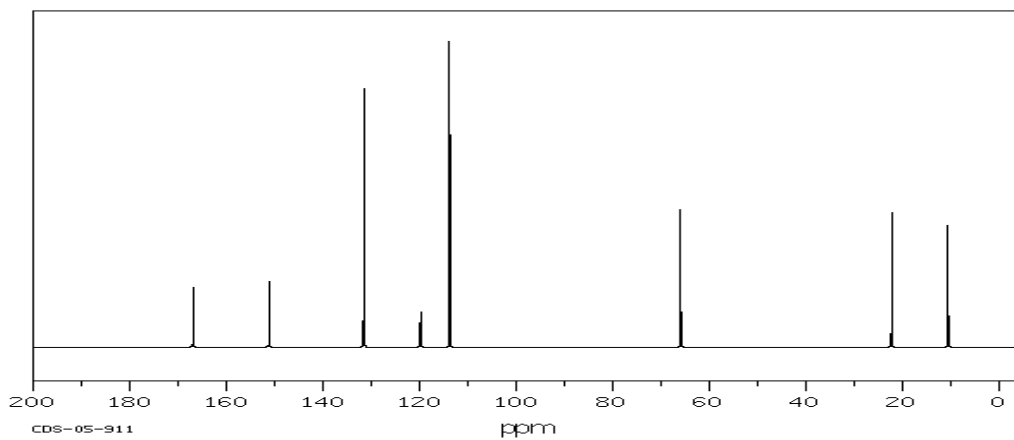


c. Suggest a structure for compound **W** based on the spectra given. **Show all your work and clearly indicate what your final answer is.**

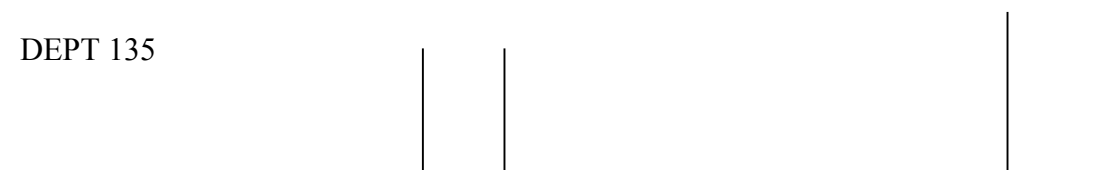


**Integration  
Multiplet**

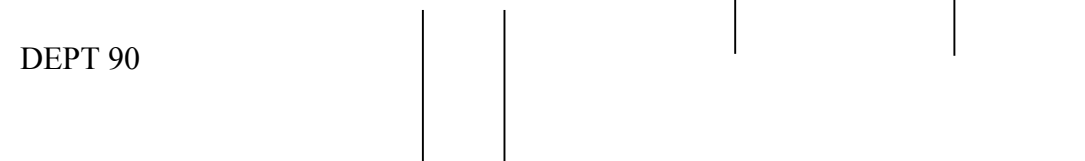
<b>2</b>	<b>2</b>	<b>2 2</b>	<b>2</b>	<b>3</b>
<b>d</b>	<b>d</b>	<b>t s</b>	<b>"m"</b>	<b>t</b>



DEPT 135



DEPT 90



DEPT 45



# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

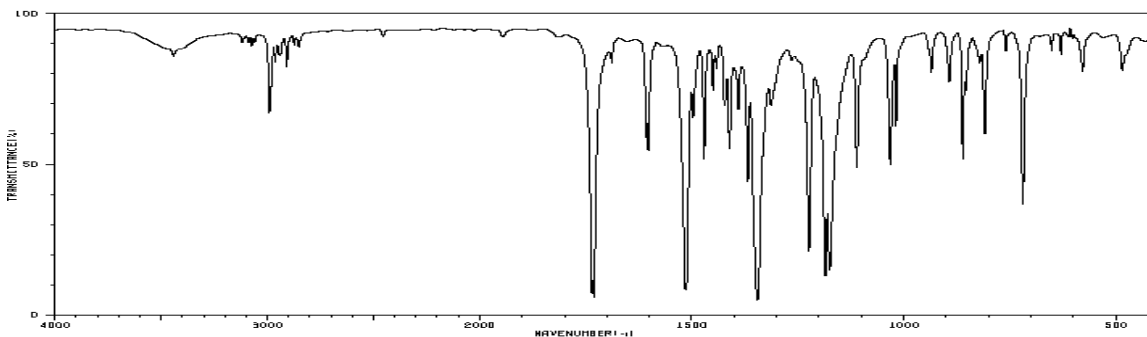
**Final Answer**

Winter 2008

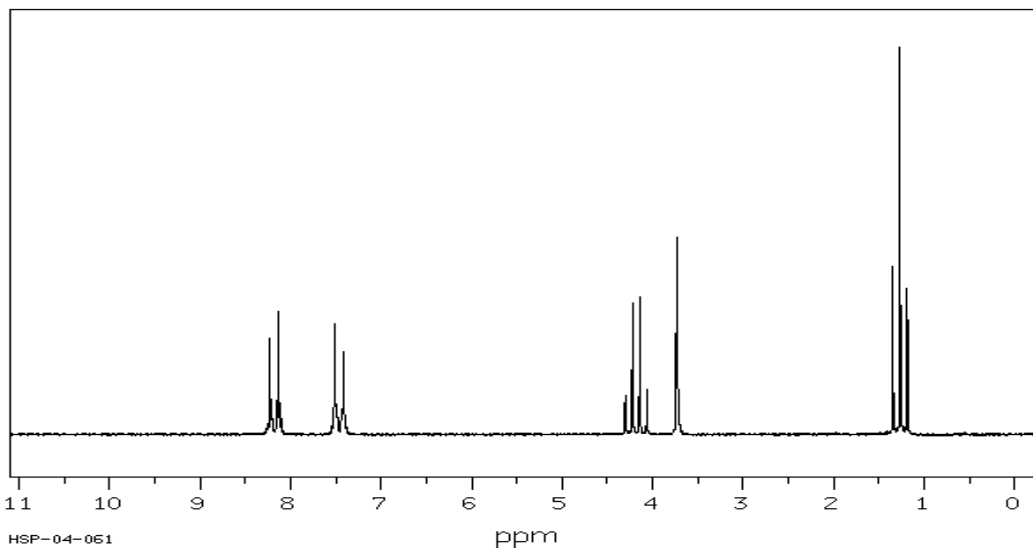
2. Compound **W** has an empirical formula of  $C_{10}H_{11}NO_4$ . Given are the following spectra.

a. Determine the degree of unsaturation for the compound.

b. Assign the five pertinent peaks in the infrared spectrum.



c. Suggest a structure for compound **W** based on the spectra given. **Show all your work and clearly indicate what your final answer is.**

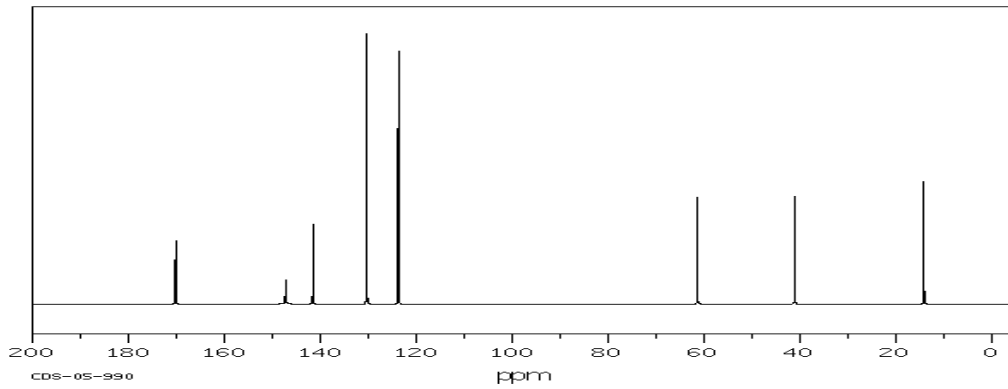


Integration

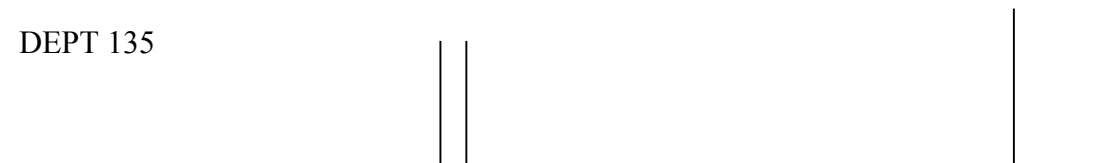
2 2

2 2

3



DEPT 135



DEPT 90



DEPT 45



# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

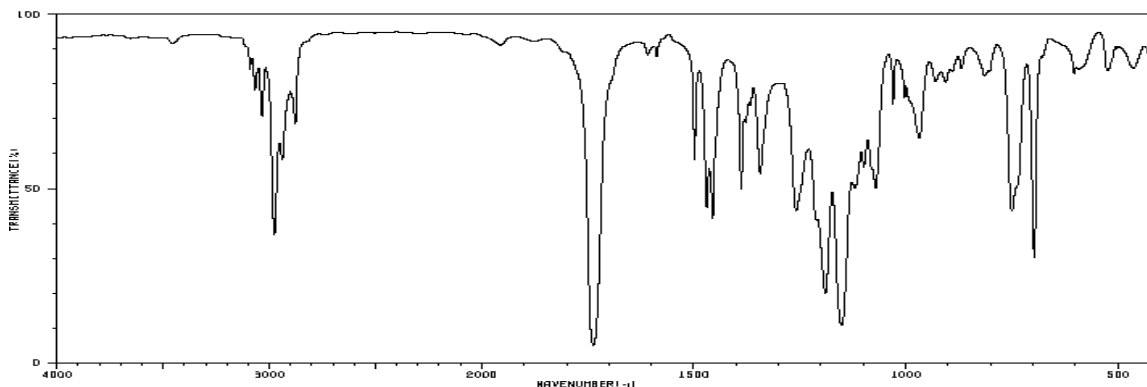


**Final Answer**

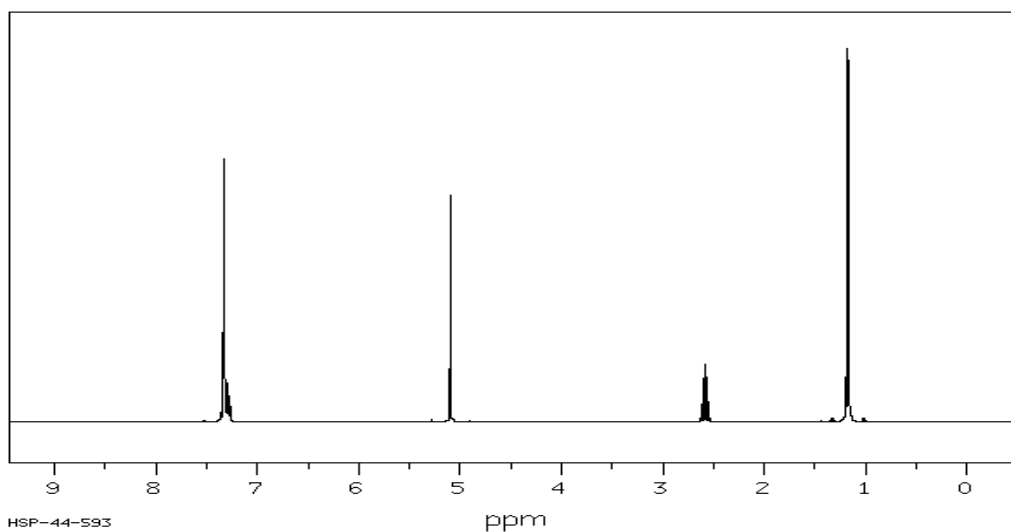
Spring 2008

3. Compound **W** has an empirical formula of  $C_{11}H_{14}O_2$ . Given are the following spectra.

- Determine the degree of unsaturation for the compound.
- Assign the five pertinent peaks in the infrared spectrum.



- Suggest a structure for compound **W** based on the spectra given. **Show all your work. Place your final answer in the box provided below. Only a molecule placed in this box will receive credit!**



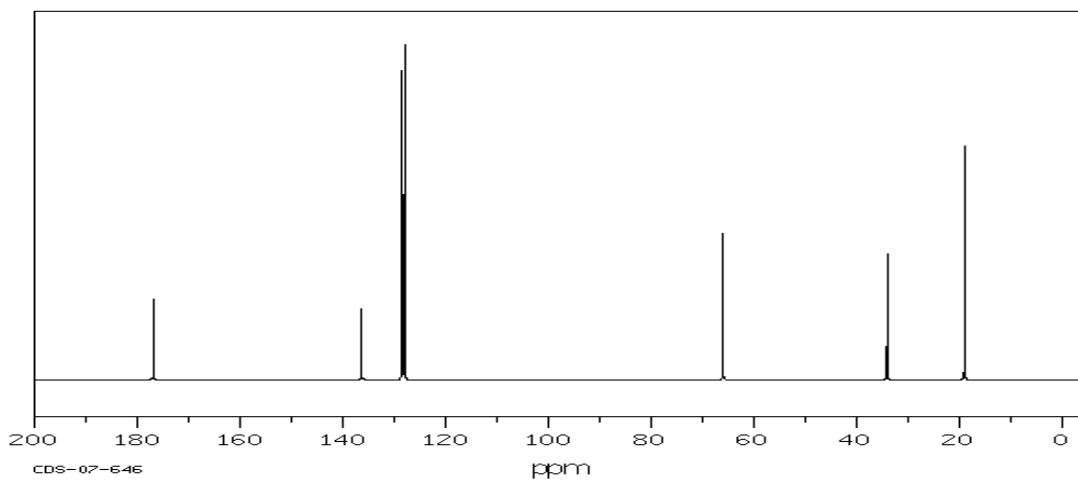
Integration

5

2

1

6



DEPT 135



DEPT 90



DEPT 45



**Note:** The signal group at 128 ppm is comprised of two tall and one medium sized signal.

# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

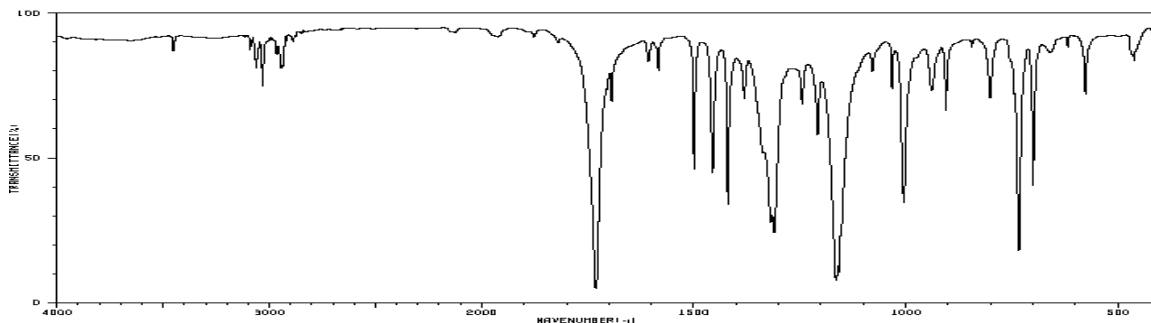
**Final Answer**

Summer 2008

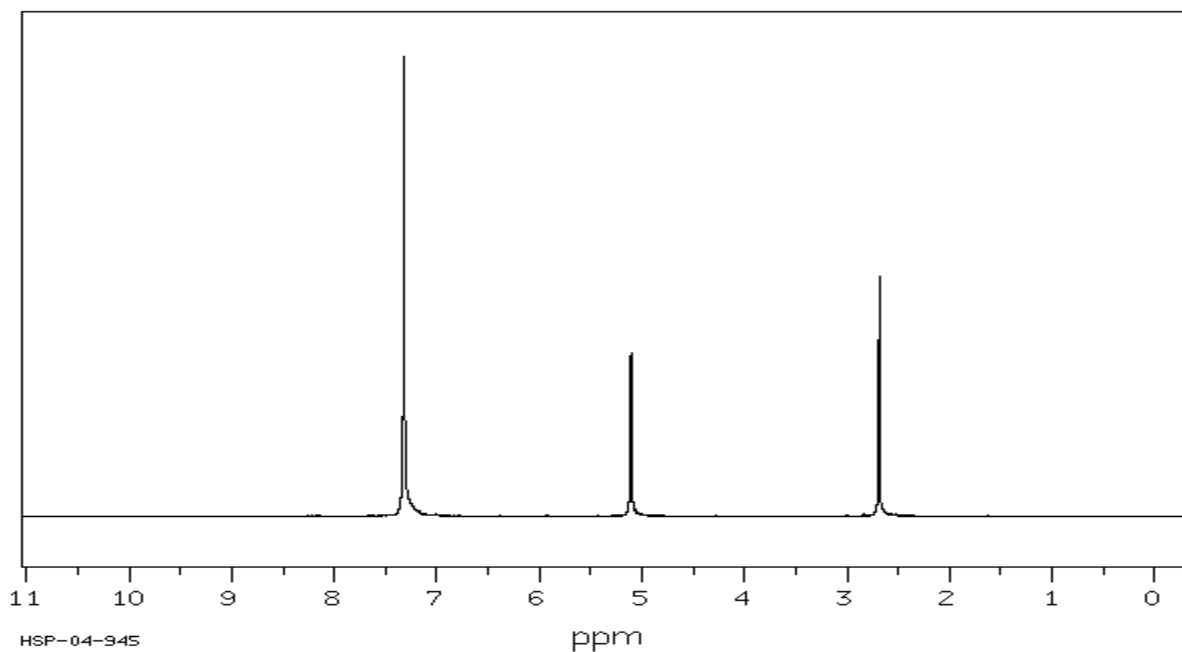
4. Compound **W** has an empirical formula of  $C_{18}H_{18}O_4$ . Given are the following spectra. **Show all your work.**

a. Determine the degree of unsaturation for the compound.

b. Assign the five pertinent peaks in the infrared spectrum.



c. Suggest a structure for compound **W** based on the spectra given. **Place your final answer in the box provided below. Only a molecule placed in this box will receive credit!**



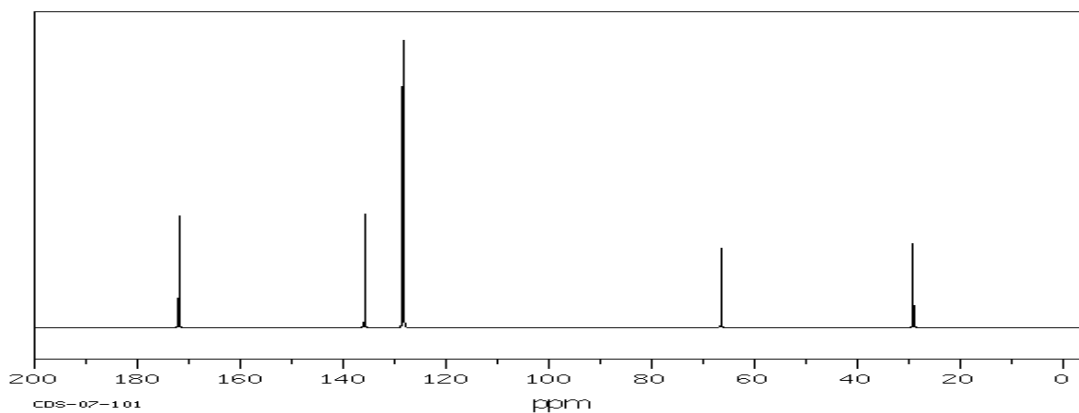
**Integration**

**5**

**2**

**2**





DEPT 135



DEPT 90



DEPT 45



**Note:** The signal group at 128 ppm is comprised of two tall and one medium sized signal.

# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up



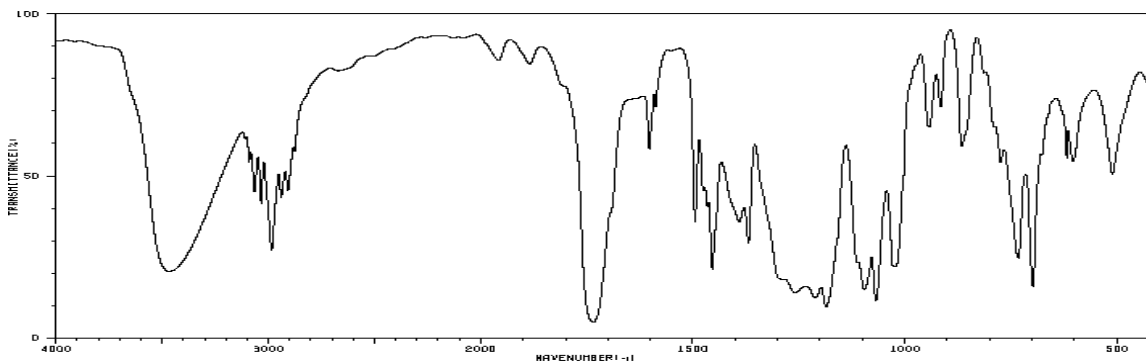
**Final Answer**

Fall 2008

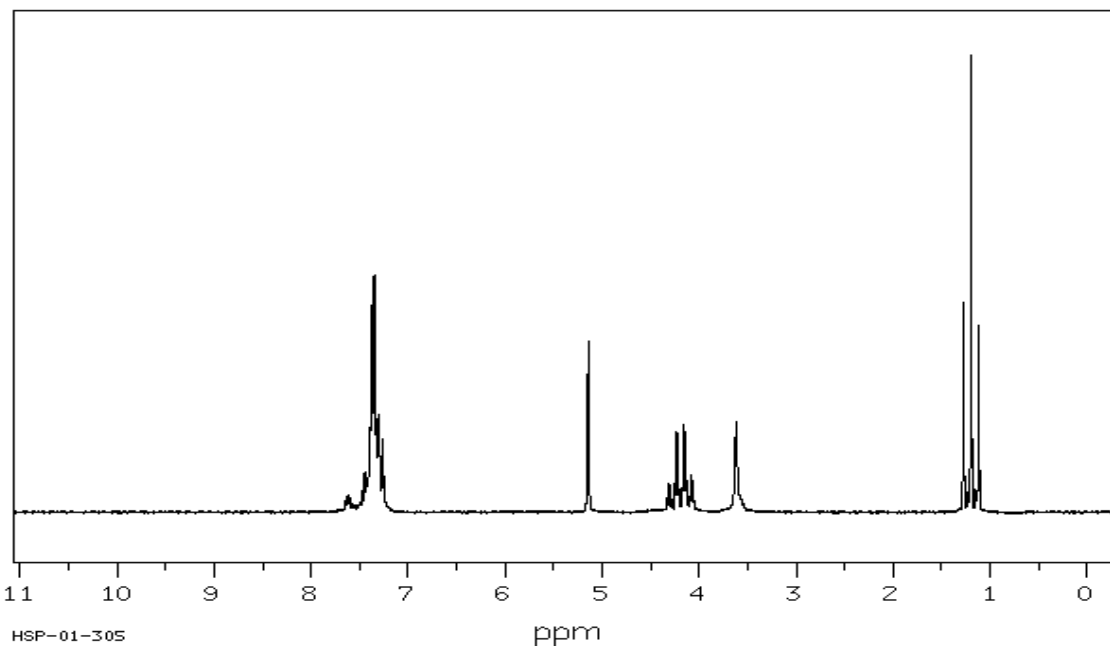
5. Compound **W** has an empirical formula of  $C_{10}H_{12}O_3$ . Given are the following spectra. **Show all your work.**

a. Determine the degree of unsaturation for the compound.

b. Assign the five pertinent peaks in the infrared spectrum.



c. Suggest a structure for compound **W** based on the spectra given. **Place your final answer in the box provided below. Only a molecule placed in this box will receive credit!**



**Integration**

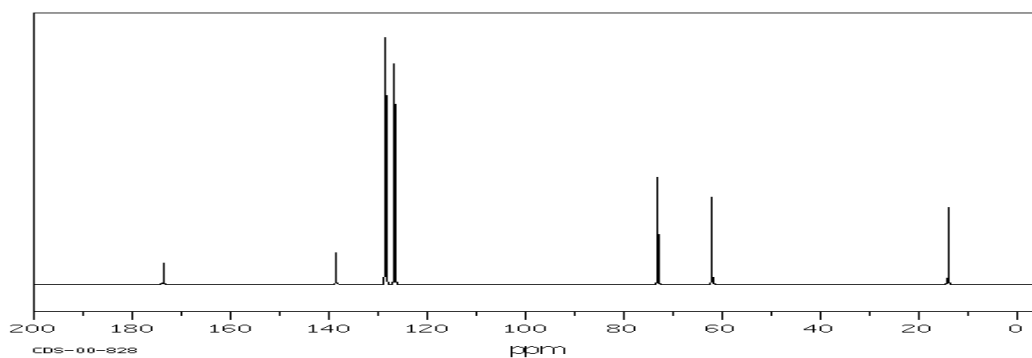
**5**

**1**

**2**

**1**

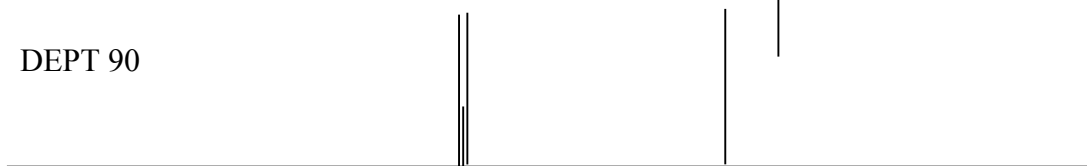
**3**



DEPT 135



DEPT 90

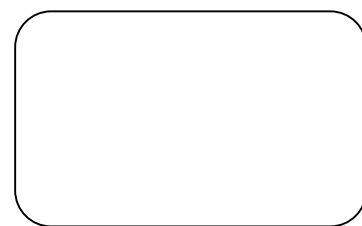


DEPT 45



**Note:** The signal group at 128 ppm is comprised of one tall and one medium sized signal (see DEPT).

# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

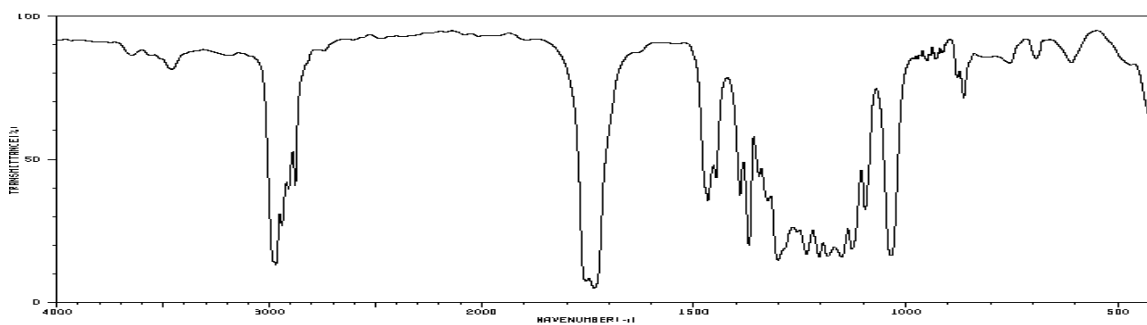


**Final Answer**

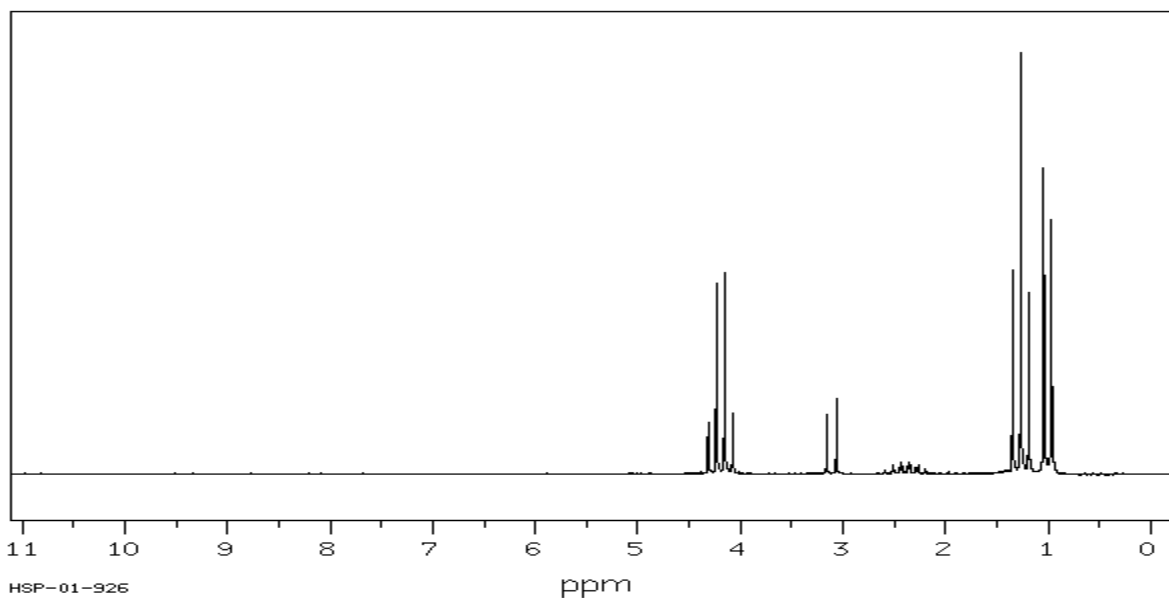
Winter 2009

6. Compound **W** has an empirical formula of  $C_{10}H_{18}O_4$ . Given are the following spectra. **Show all your work.**

- Determine the degree of unsaturation for the compound.
- Assign the four pertinent peaks in the infrared spectrum.

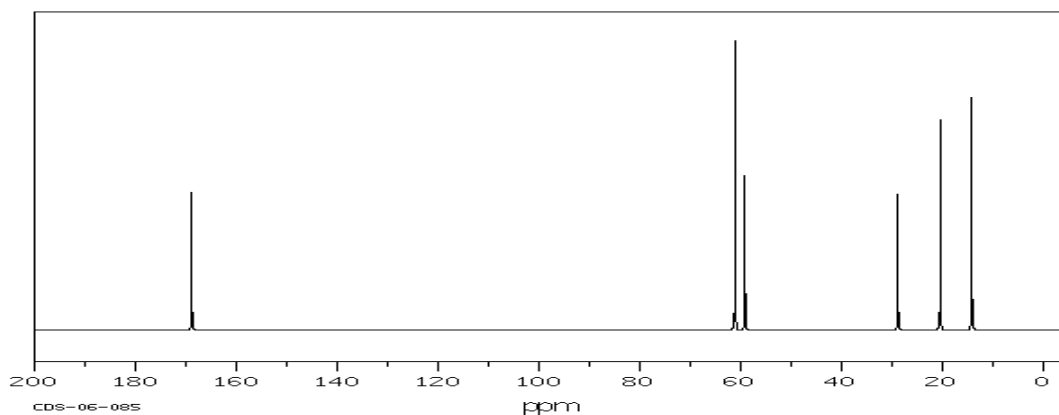


- Suggest a structure for compound **W** based on the spectra given. **Place your final answer in the box provided below. Only the molecule placed in this box will receive credit!**



**Integration**

**4 1 1 6 6**



DEPT 135



DEPT 90



DEPT 45



# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

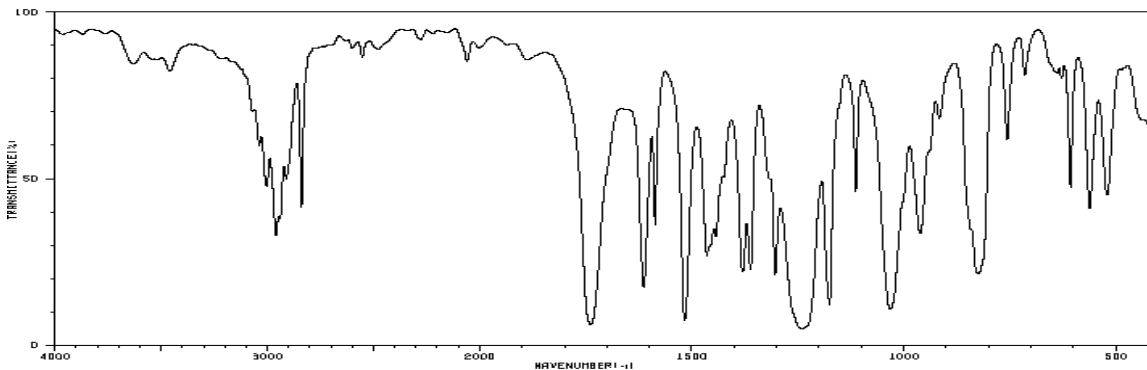
**Final Answer**

Summer 2009

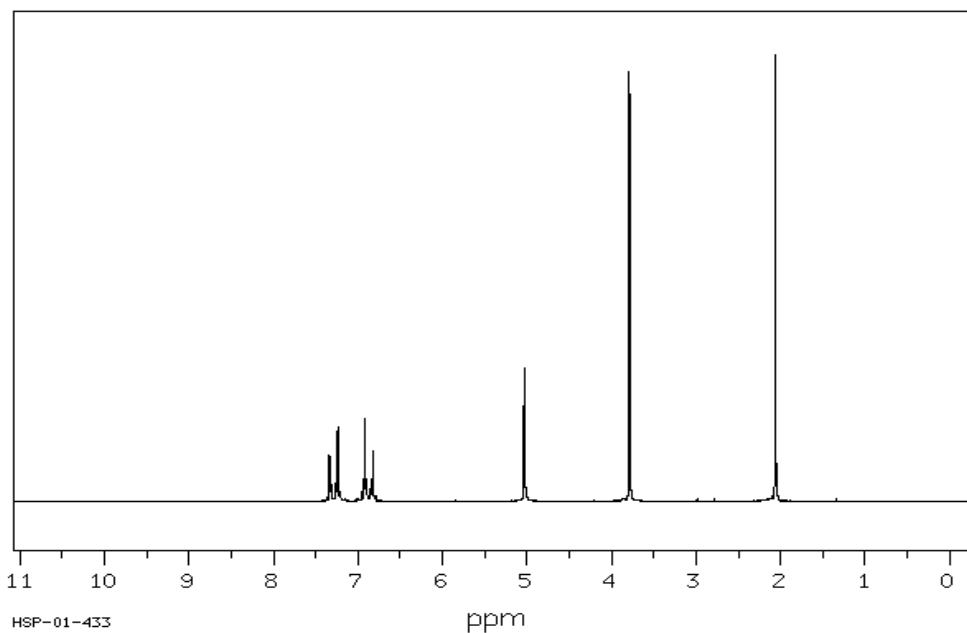
7. Compound **W** has an empirical formula of  $C_{10}H_{12}O_3$ . Given are the following spectra. **Show all your work** (= label peaks in the spectra!)

a. Determine the degree of unsaturation for the compound.

b. Assign the five pertinent peaks in the infrared spectrum.



c. Suggest a structure for compound **W** based on the spectra given. **Place your final answer in the box provided below. Only the molecule placed in this box will receive credit! Partial structures and structures, which do not meet the molecular formula, will not any receive credit.**



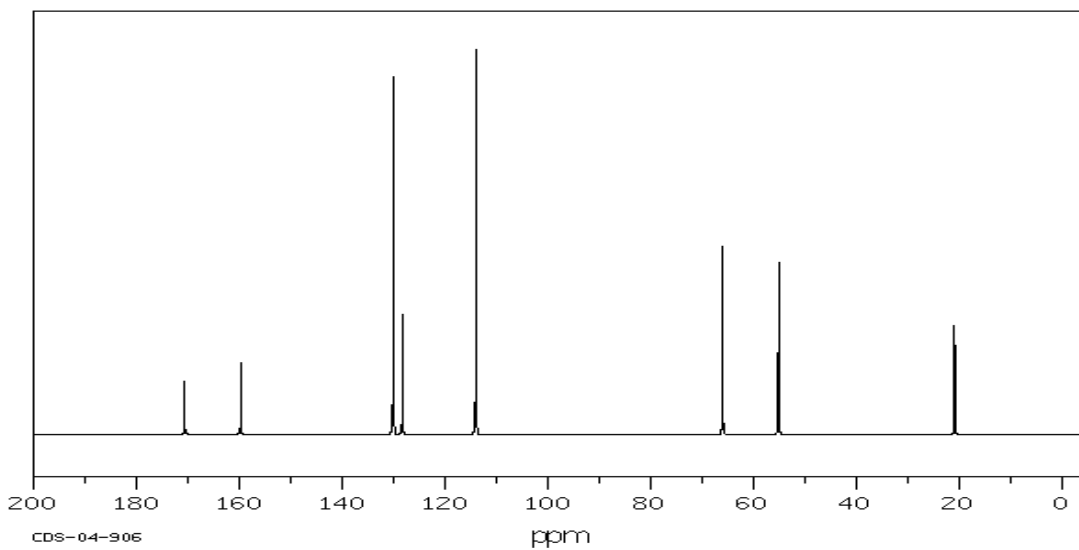
**Integration**

**2 2**

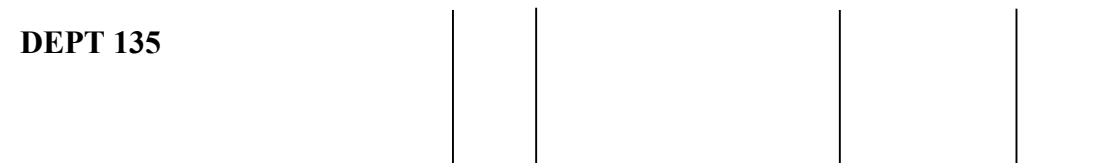
**2**

**3**

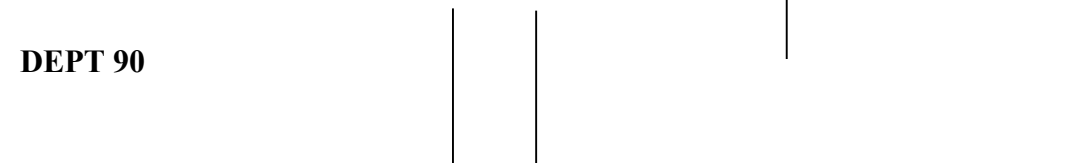
**3**



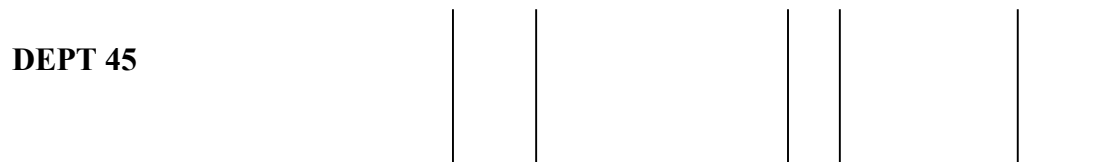
**DEPT 135**



**DEPT 90**



**DEPT 45**



# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up



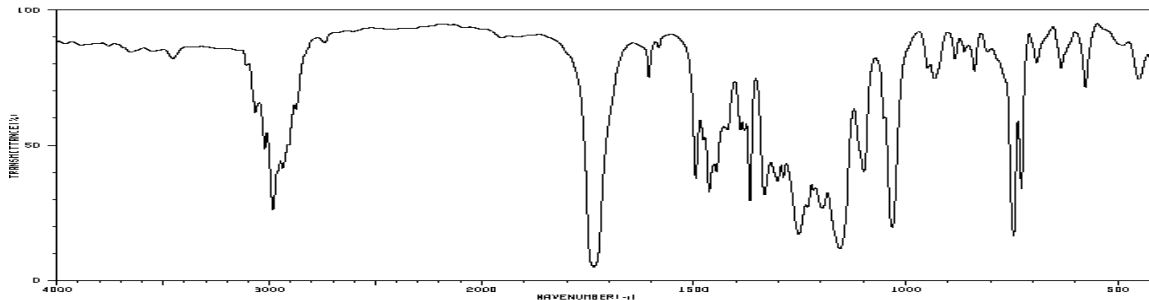
**Final Answer**

Fall 2009

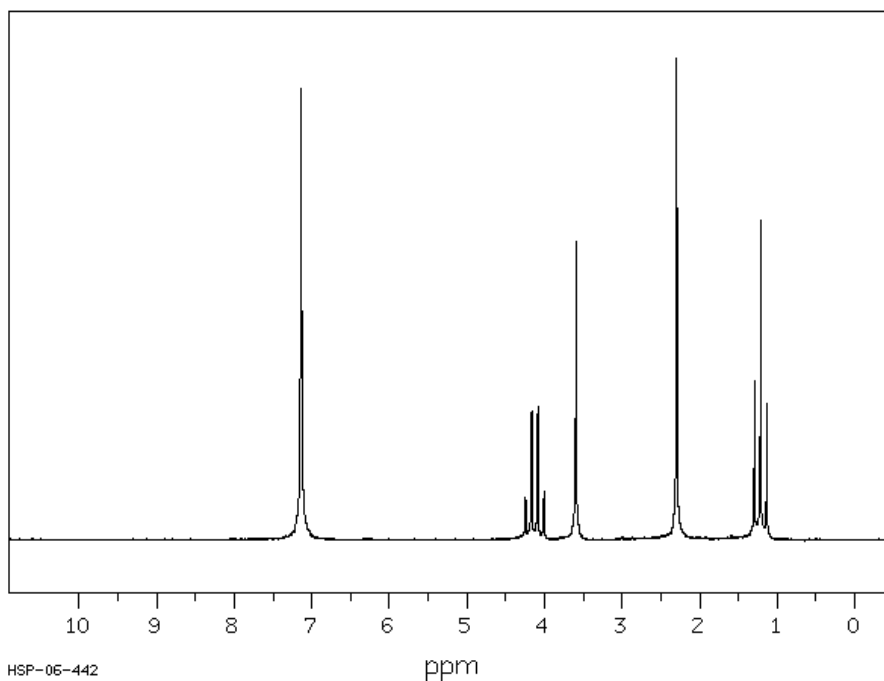
8. Compound **W** has an empirical formula of  $C_{11}H_{14}O_2$ . Given are the following spectra. **Show all your work** (= label peaks in the spectra!)

a. Determine the degree of unsaturation for the compound.

b. Assign the five pertinent peaks in the infrared spectrum.



c. Suggest a structure for compound **W** based on the spectra given. Place your final answer in the box provided below. **Only the molecule placed in this box will receive credit! Partial structures and structures, which do not meet the molecular formula, will not any receive credit.**

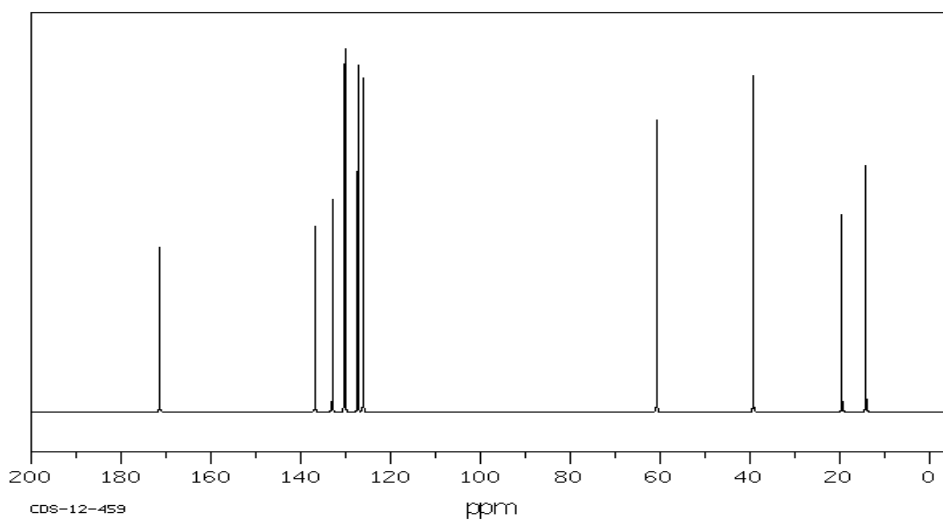


**Integration  
Multiplet**

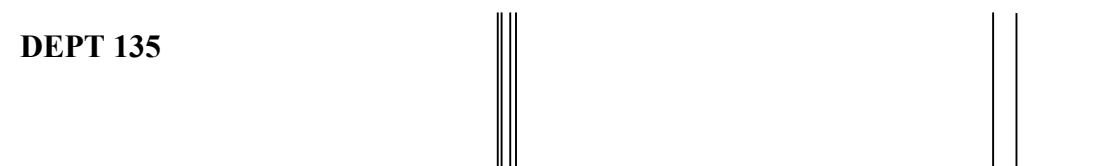
**4  
d/d/t/t**

**2 2 3 3**

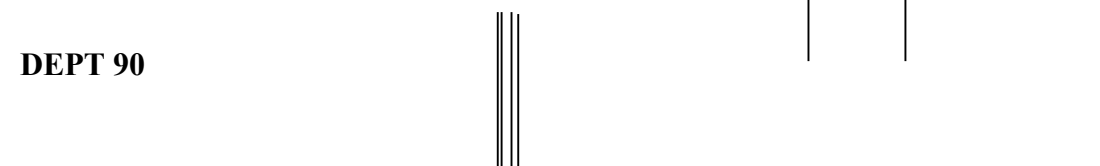




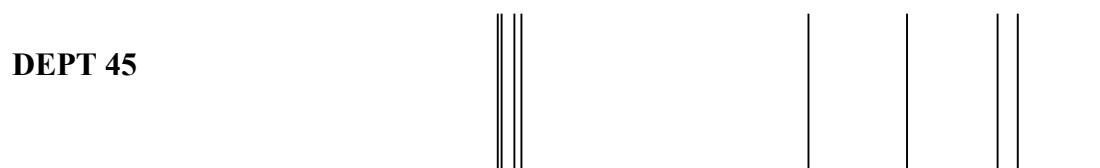
**DEPT 135**



**DEPT 90**



**DEPT 45**



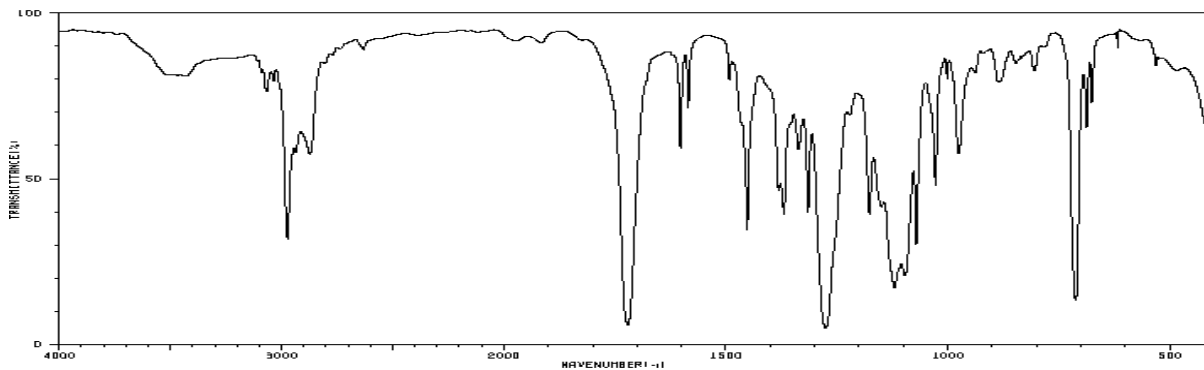
# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

**Final Answer**

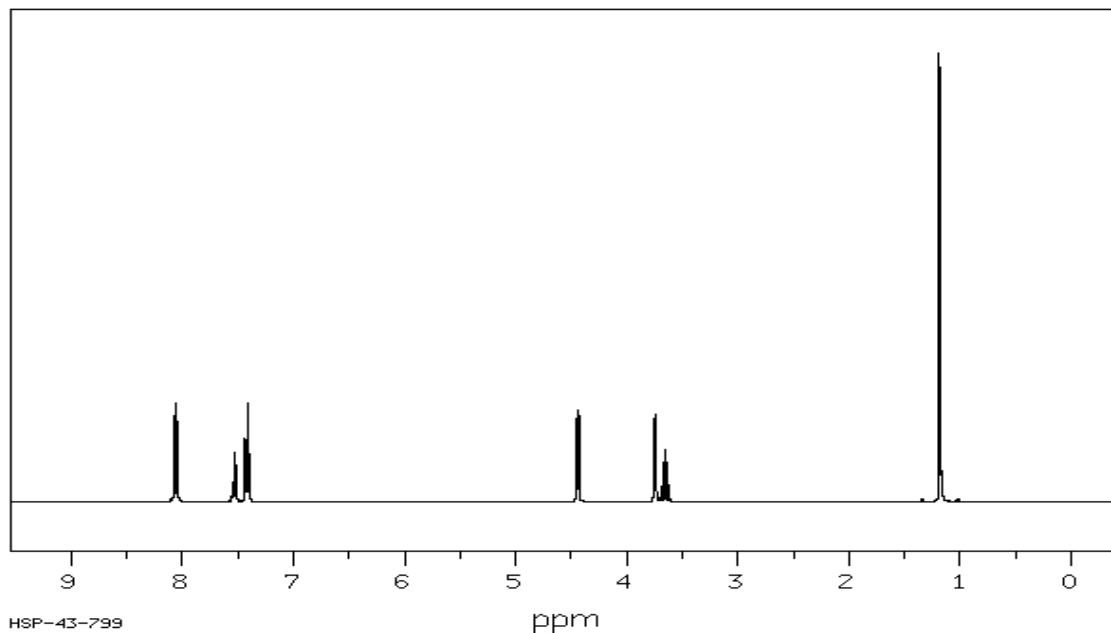
Winter 2010

9. Compound *W* has an empirical formula of  $C_{12}H_{16}O_3$ . Given are the following spectra. **Show all your work** (= label peaks in the spectra!)

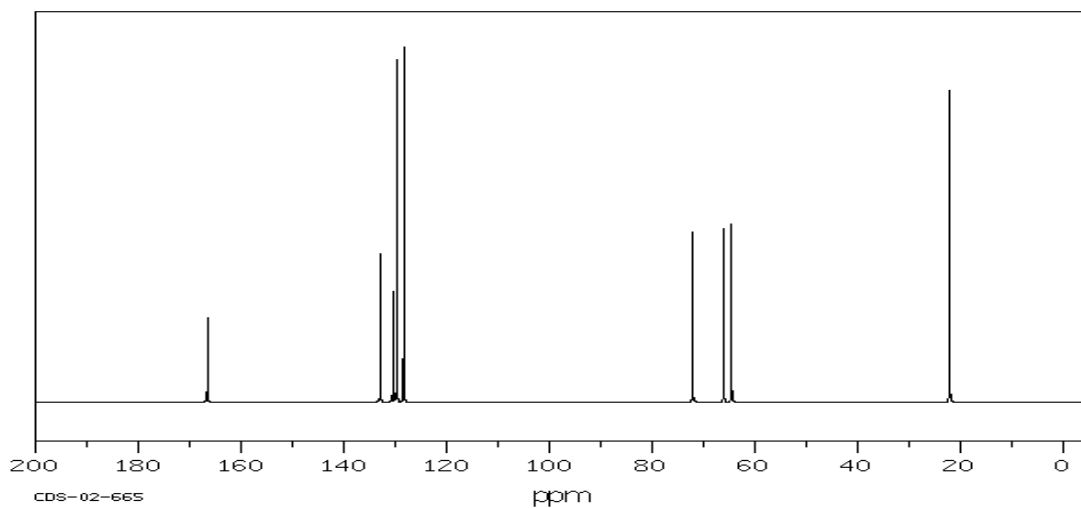
- Determine the degree of unsaturation for the compound.
- Assign the five pertinent peaks in the infrared spectrum.



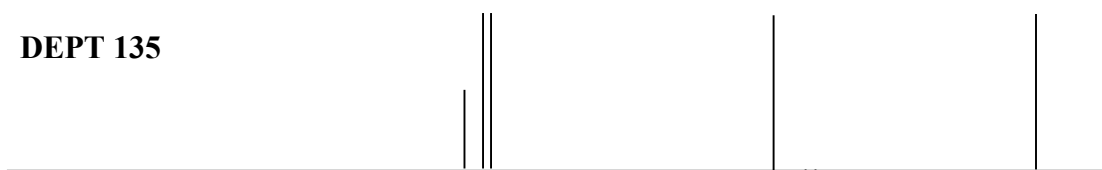
- Suggest a structure for compound *W* based on the spectra given. Place your final answer in the box provided below. **Only the molecule placed in this box will receive credit! Partial structures and structures, which do not meet the molecular formula, will not any receive credit.**



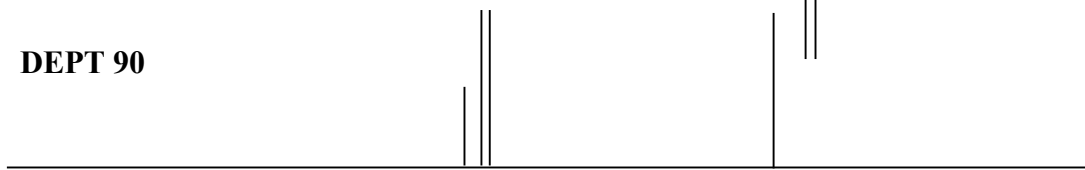
<b>Integration</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>6</b>
<b>Multiplet</b>	<b>d</b>	<b>t</b>	<b>t</b>	<b>t m</b>	<b>d</b>



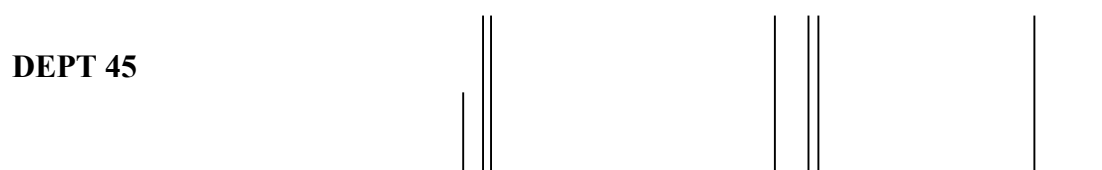
**DEPT 135**



**DEPT 90**



**DEPT 45**



# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

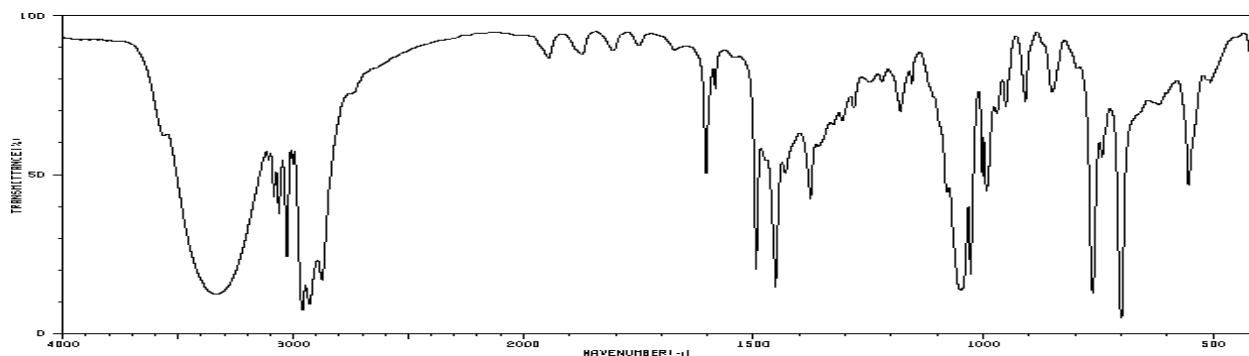
**Final Answer**

Spring 2010

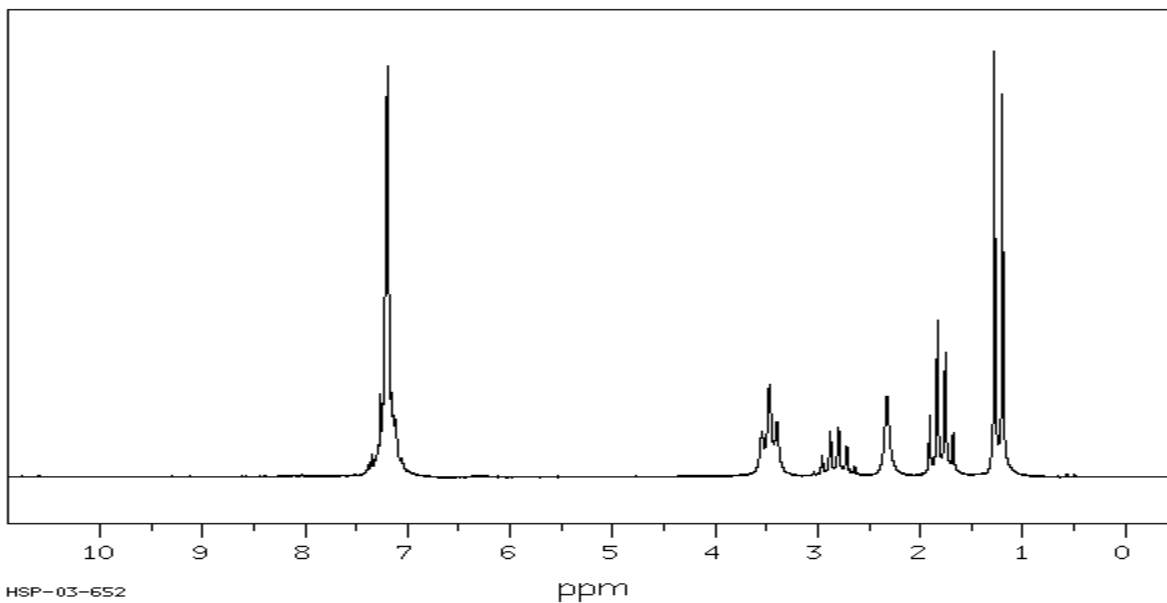
10. Compound *W* has an empirical formula of  $C_{10}H_{14}O$ . Given are the following spectra. **Show all your work** (= label peaks in the spectra!)

a. Determine the degree of unsaturation for the compound.

b. Assign the five pertinent peaks in the infrared spectrum.



c. Suggest a structure for compound *W* based on the spectra given. Place your final answer in the box provided below. **Only the molecule placed in this box will receive credit! Partial structures and structures, which do not meet the molecular formula, will not any receive credit.**



**Integration**

**5**

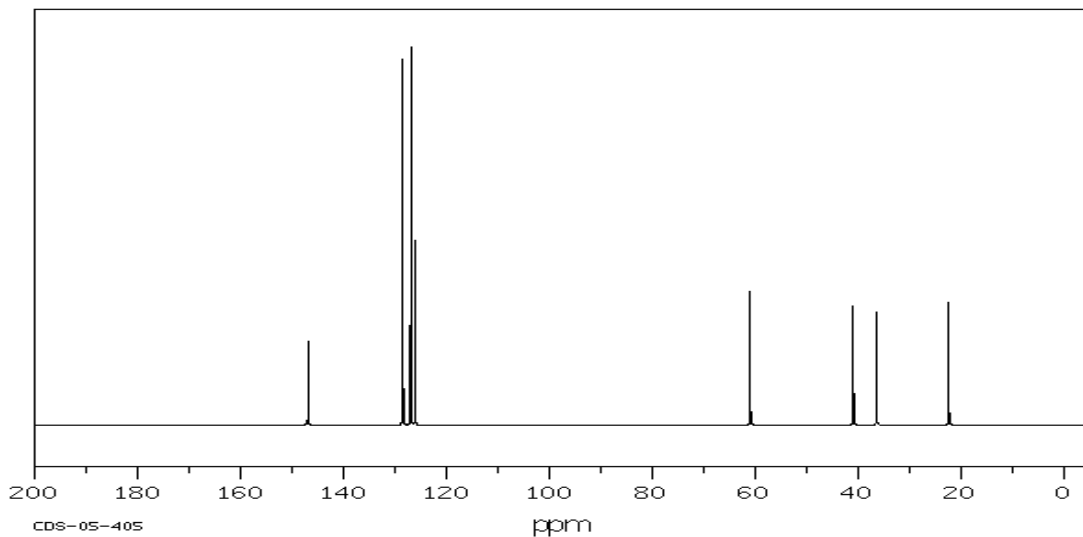
**2**

**1**

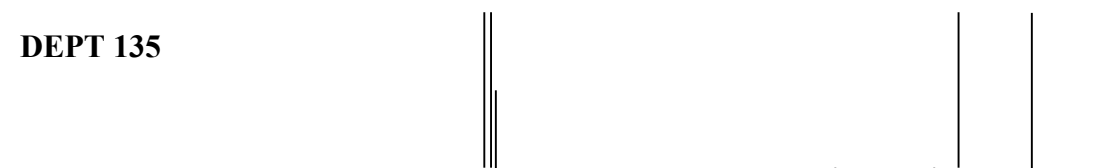
**1**

**2**

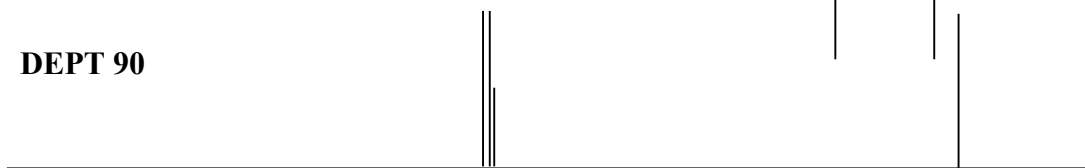
**3**



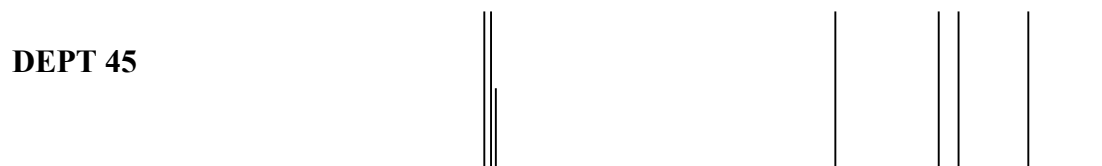
**DEPT 135**



**DEPT 90**



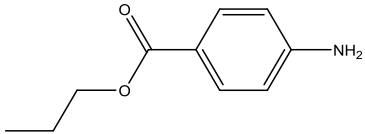
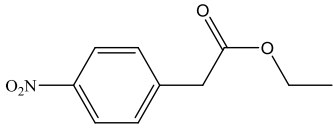
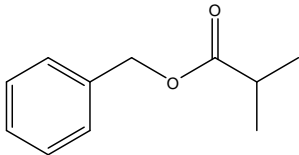
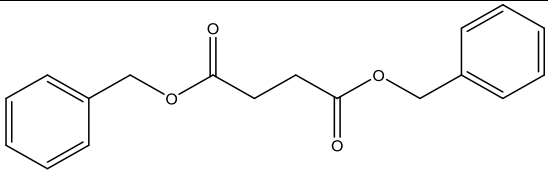
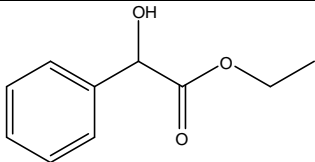
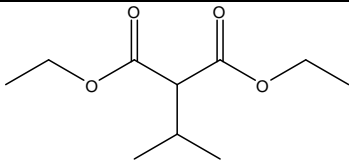
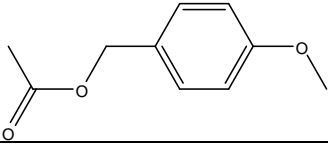
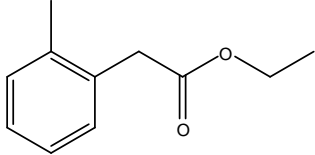
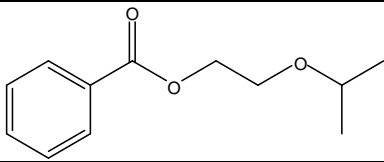
**DEPT 45**



# of attached hydrogens	0	1	2	3
DEPT 135	0	up	down	up
DEPT 90	0	up	0	0
DEPT 45	0	up	up	up

**Final Answer**

## Answers

1	Fall 2007	
2	Winter 2008	
3	Spring 2008	
4	Summer 2008	
5	Fall 2008	
6	Winter 2009	
7	Summer 2009	
8	Fall 2009	
9	Winter 2010	
10	Spring 2010	