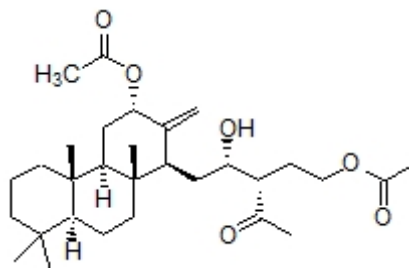
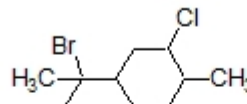
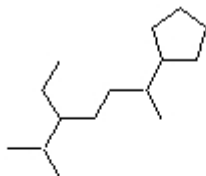


## I. Nomenclature

1. Flabelliferin A, shown below, was isolated from a marine sponge and was found to have cytotoxic activity. (*J. Nat. Prod.* **2012**, 1490). Circle and identify each different functional group in this structure. (8 points)



2. How many tertiary carbons are there in Flabelliferin A, shown above? (3 points)
3. Identify the correct IUPAC name for each of the compounds shown below. (6 points)



- |  |  |
|--|--|
| a) 1-cyclopentyl-4-ethyl-1,5-dimethylhexane  | a) 1-(1-bromo-s-butyl)-3-chloro-4-methylcyclohexane        |
| b) 2-cyclopentyl-5-isopropylheptane          | b) 4-(1-bromo-1-methylpropyl)-2-chloro-1-methylcyclohexane |
| c) 1-cyclopentyl-5-ethyl-2,6-dimethylheptane | c) 4-(1-bromo-s-butyl)-2-chloro-1-methylcyclohexane        |
| d) 6-cyclopentyl-3-ethyl-2-methylheptane     | d) 5-(1-bromo-1-methylpropyl)-1-chloro-2-methylcyclohexane |
| e) 2-cyclopentyl-5-ethyl-6-methylheptane     | e) 1-chloro-5-(2-bromo-2-methylpropyl)-2-methylcyclohexane |

4. Name the following bicyclic compound. (3 points)



## II. Conformations and Structure

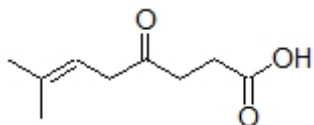
1. Draw a Lewis structure for carbonic acid,  $\text{H}_2\text{CO}_3$ . (3 points)
2. State the number of sigma bonds and pi bonds in  $\text{NCCH}_2\text{CO}_2\text{H}$ . (4 points)

Sigma bonds: \_\_\_\_\_

Pi bonds: \_\_\_\_\_

3. The carbon-nitrogen sigma bond in the structure in problem 2 is constructed from the overlap of a(n) \_\_\_\_ atomic orbital of carbon with a(n) \_\_\_\_ atomic orbital of nitrogen. (3 points)
  - a)  $\text{sp}^2$ , sp
  - b) sp,  $\text{sp}^2$
  - c)  $\text{sp}^2$ ,  $\text{sp}^2$
  - d) sp, sp
  - e) p, p
4. If an unknown compound was found to have 7 carbons, 1 nitrogen, 1 oxygen, 1 chlorine and  $6^\circ$  of unsaturation, how many hydrogens does it have? (3 points)

5. Translate the following line-angle structure to a condensed structure. (4 points)



6. A bond angle of \_\_\_\_\_ corresponds to an  $\text{sp}^3$  hybridized center. (2 points)
7. Draw all isomers of  $\text{C}_4\text{H}_9\text{Br}$  and **circle** the isomer with the lowest boiling point. (6 points)

8. Which sequence correctly ranks the following rings in order of increasing stability? (3 points)

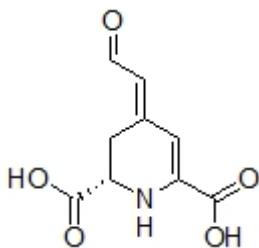
1 cyclohexane

2 cycloheptane

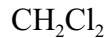
3 cyclooctane

- a) 1<2<3    b) 2<3<1    c) 3<1<2    d) 3<2<1    e) 2<1<3    f) 1<3<2

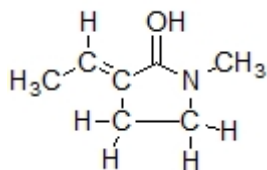
9. Betalamic Acid, is a naturally occurring compound that combines with amines to give the colored pigment found in many fruits and flowers. (*J. Nat. Prod.* **2012**, 1030). Circle all hydrogen bond donors in betalamic acid. (4 points)



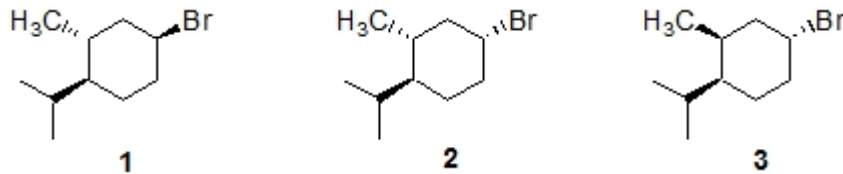
10. Circle any structure below that can be classified as polar. (6 points)



11. Draw 3 additional significant resonance structures for the structure below. Include any formal charges. Circle the major resonance contributor. (10 points)

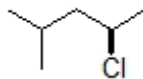


12. Which sequence ranks the following structures in order of increasing stability? Justify your answer by drawing each chair in its most stable chair conformation. (8 points)

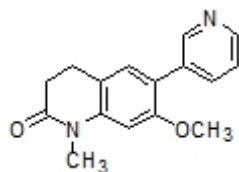


- a) 1<2<3    b) 2<3<1    c) 3<1<2    d) 3<2<1    e) 2<1<3    f) 1<3<2

13. Siting down the C2-C3 bond, draw a Newman projection for the most stable conformation of the structure shown below. (3 points)

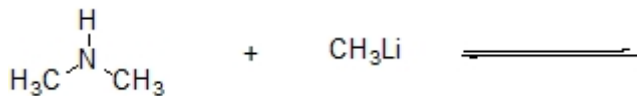


14. The following compound has been found effective in treating breast cancer and cardiovascular disease (*J. Med. Chem.*, **2012**,7080). How many  $sp^2$  centers are in this compound? (4 points)

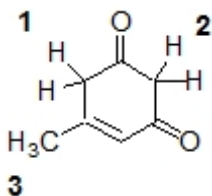


### III. Reactivity

1. Complete the following acid base reaction and indicate whether the starting materials or products would be favored. ( 4 points)



2. Which sequence correctly ranks the following protons in order of increasing acidity? (3 points)



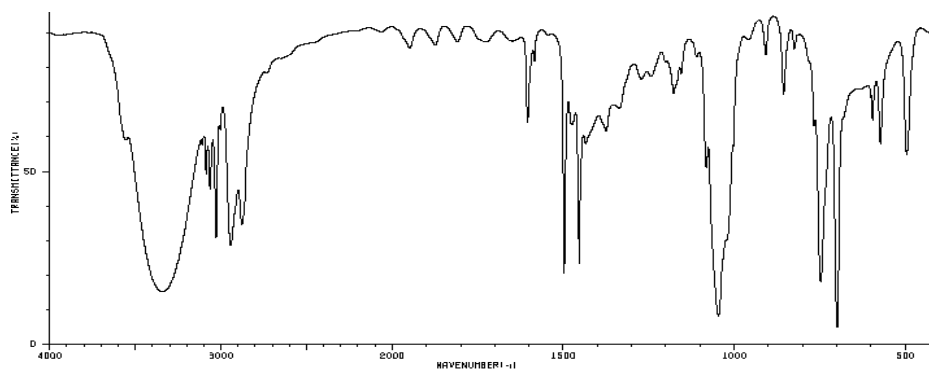
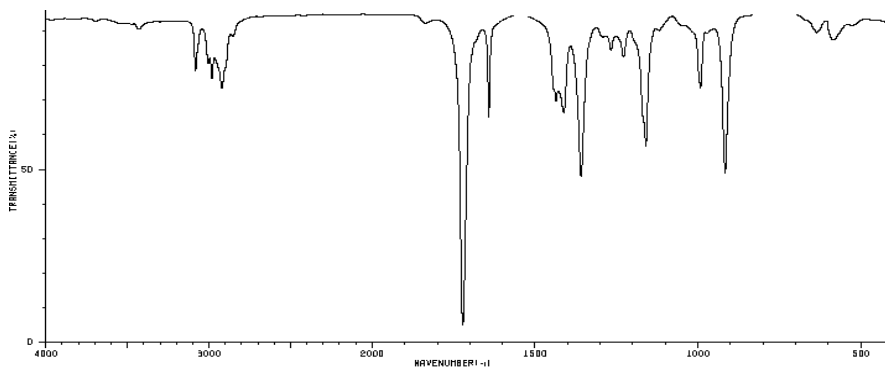
- a) 1<2<3      b) 2<3<1      c) 3<1<2      d) 3<2<1      e) 2<1<3      f) 1<3<2

3. An Bronsted-Lowry base is defined as: (2 points)

- a) Any compound that can accept a pair of electrons.
- b) Any compound that can donate a pair of electrons.
- c) Any compound that can accept a proton.
- d) A substance that generates OH<sup>-</sup> ions when dissolved in water.
- e) Any compound that can donate a proton.

### IV. IR spectroscopy

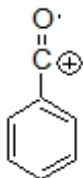
- State the functional groups represented in each of the infrared (IR) spectra shown below. Justify your answer by labeling key peaks in each spectra. (8 points, see the IR table on the bottom of this page.)



alcohol $\text{CH}_3\text{O-H}$ (broad) strong	$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{H}$ broad	$-\text{C}\equiv\text{N}$ $-\text{C}\equiv\text{C}-$ (weak absorbance)	carbonyl (strong absorb.) Ketones Aldehyde Ester Amide Carbox. Acids	alkene $\text{C}=\text{C}$	Aromatic Ring (1600)	Finger print region
amine $(\text{CH}_2)_2\text{N-H}$	$\text{sp}^2 \text{ C-H (C=C-H)}$ $\text{sp}^3 \text{ C-H (R-CH}_3)$					
amide $\text{CH}_3\text{CONH}_2$						
terminal alkyne $\text{CH}_3\text{-C}\equiv\text{C-H}$ (sharp)						
3300 $\text{cm}^{-1}$	3000 $\text{cm}^{-1}$	2200 $\text{cm}^{-1}$	1700 $\text{cm}^{-1}$	1600 $\text{cm}^{-1}$		

**V. Extra Credit (5 points)**

1. Draw 4 additional resonance structures for the cation shown below. Circle the major contributor to the overall resonance hybrid.



You received \_\_\_\_\_ points out of 100 points possible. To check your overall performance in lecture see <http://canvas.weber.edu> .

A study is being conducted to determine what factors strongly effect academic performance in either a positive or negative manner. The intent of the collected data is to assist me in better advising students on how to be successful academically. It is anticipated that the results of this survey will be published in a pedagogical journal, such as The Journal of Chemical Education. Be assured that your response to this survey will be held completely anonymous since the survey will be separated from your exam before processing data. Your choice to participate in this survey will neither effect your grade positively or negatively, and you are free to terminate your participation at any time. If you have any questions, please contact me, Dr. Don Davies, at 801-626-6224 or [ddavies1@weber.edu](mailto:ddavies1@weber.edu) .

I predict I received \_\_\_\_\_ points out of 100 points possible on this exam. Actual score \_\_\_\_.

	<b>How often did you:</b>	never				always
2	Read the material planned for the following lecture?	1	2	3	4	5
3	Complete the in-chapter problems?	1	2	3	4	5
4	Complete the end-of-chapter assigned problems?	1	2	3	4	5
5	Complete online practice quizzes and exams?	1	2	3	4	5
6	Read the assigned pages in the book?	1	2	3	4	5
7	Highlight and summarize book and/or notes?	1	2	3	4	5
8	Make and review flash cards?	1	2	3	4	5
9	Participate in a study group?	1	2	3	4	5
10	Verbally explain principles to another individual?	1	2	3	4	5
11	Write assessment questions of your own?	1	2	3	4	5
12	Receive 6 or more hours of sleep?	1	2	3	4	5
13	Go to bed & arise at the same time (M-Th) (+/- 1 hr)?	1	2	3	4	5
14	Maintain the same sleep pattern on the weekend?	1	2	3	4	5
15	Take time to exercise and/or relax?	1	2	3	4	5
16	Eat a "healthy" breakfast?	1	2	3	4	5
17	How many hours of sleep did you receive last night?	$\leq 4$	5	6	7	$\geq 8$
18	How many hours / day did you study M-Th?	$\leq 2$	3	4	5	$\geq 6$
19	How many hours committed elsewhere (work, different class, church, etc....)?	$\leq 5$	10	20	30	$\geq 40$
20	How many days did you meet with a tutor?	0	1	2	3	$\geq 4$
21	State your level of anxiety on this exam. (1 is low, 5 is high)	1	2	3	4	5
22	What was your grade in Chem 1220 (Gen. Chem.)?	A	B	C	D	E
23	How well do you like Organic Chemistry? (1 is low, 5 is high)	1	2	3	4	5