I pledge that I will do this test by myself and I will not give or receive help from anybody. I will not break the trust of Dr. Castillo by committing any form of fraud, by searching for the answers on the internet or by uploading the questions of this test on any website in order to get the answers. I understand that Dr. Castillo reserves the right to reach out to me and do an oral evaluation of the topics of this exam when and how she sees fit. I recognize there will be consequences, such as failing this test, if there is any form of cheating and that it will be reported to the Dean of Students for further academic actions. This test is a copyrighted material of the course instructor. Unauthorized sharing, dissemination or reproduction of any part of the exam in any form without explicit written permission from the instructor is a direct violation of the UCLA Conduct Code 102.23.

×

Name: Key

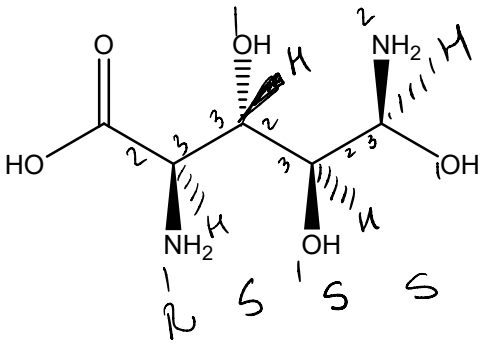
Date: _____

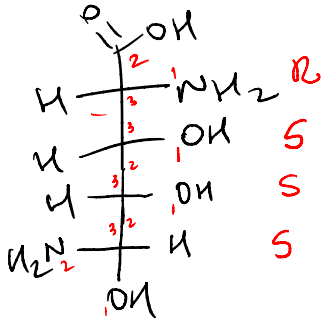
Assessment (May 7th)

Chem14C-Spring 2021
Prof. Castillo

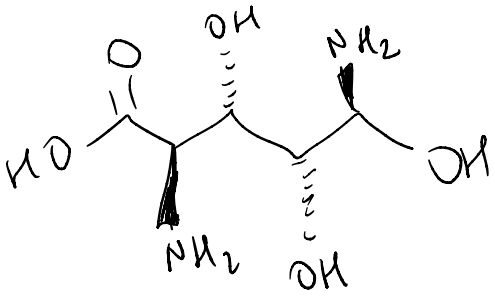
1- For the following molecule:

a) Draw the Fischer Projection for the following structure. Remember there will be many correct projections possible.
b) Use the Cahn-Ingold-Prelog System to assign the stereochemistry of the chiral carbons in the Fischer Projection.





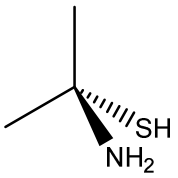
c) Draw one diastereomer of the molecule on top.



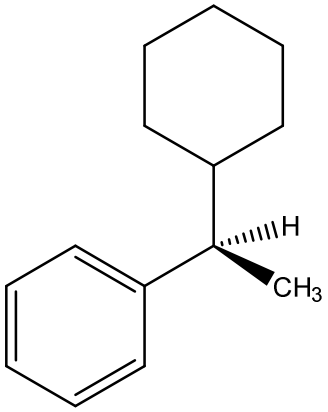
d) What is the Definition of an enantiomer?

STEREOISOMERS THAT HAVE THE SAME MOLECULAR FORMULA, SAME ATOM CONNECTIVITY BUT OPPOSITE SPATIAL ORIENTATION (OR CONFIGURATION).

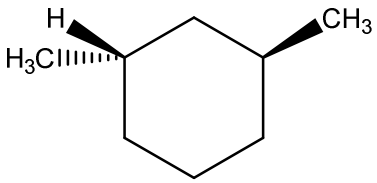
e) Specify if the following molecules are chiral, achiral, or meso.



achiral



chiral



chiral

2- List the major intermolecular forces in the following chemicals and rank them in the order of increasing boiling point.

a) Major intermolecular forces:

A. NO DD

B. NH_3 H-BOND

C. KCl anion - cation

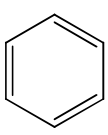
D. N_2 LDF

b) Order of increasing boiling point:

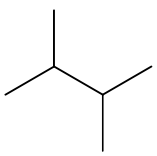
D < A < B < C

3- Rank the following molecules in the order of increasing boiling point

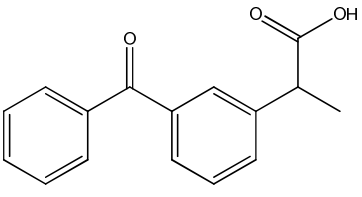
A.



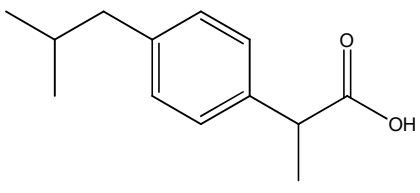
B.



C.



D.



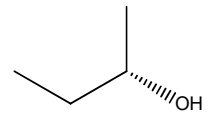
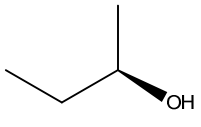
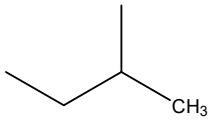
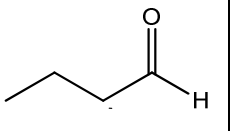
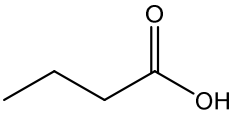
a) Order of increasing boiling point:

B < A < D < C

b) Which would be a better solvent to dissolve a mixture of all the chemicals above? Circle one.

Water (benzene)

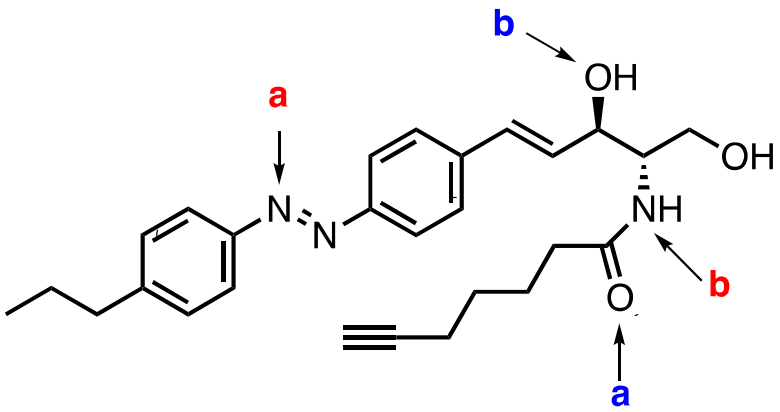
4- Compare the boiling point and water solubility of the following molecules. INCREASING

A	B	C	D	E
				
2-butanol	2-Butanol	2methyl-Butanol	Butanal	Butanoic acid

a) Boiling point: C < D < A = B < E

b) Water solubility: C < D < A = B < E

5- A research group at NYU reported short ceramide analogs that can be activated with light. These molecules, termed scaCers, exhibit increased cell permeability compared to their long-chain analogs. Notably, scaCers enable optical control of apoptosis, which is not observed with the long-chain analogs (*ACS Chem. Biol*. **2021**, *16*, 452–456). Based on the given scaCer molecule structure, answer the following questions.



scaCer

a) Name 4 functional groups that are existing in scaCer molecule.

alkyne, alcohol, amide, alkene arene

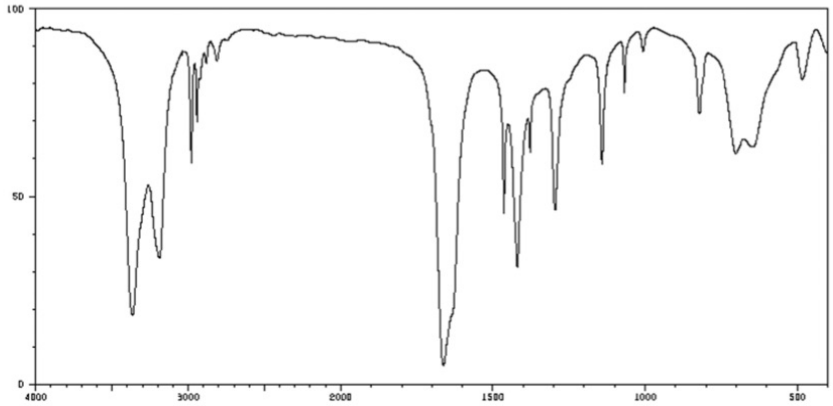
b) Use the molecule above the answer the following:
Indicate the number of ~~double~~ pi bonds 11
Indicate the number of pi electrons 24
Indicate the number of sp^2 hybridized atoms 19
Indicate the number of atoms that are in the ***longest conjugated chain*** 16

c) For the lone pairs on nitrogen **a** and nitrogen **b**, which orbitals are the lone pairs in?
LPs on Nitrogen **a** sp^2
LPs on Nitrogen **b** p

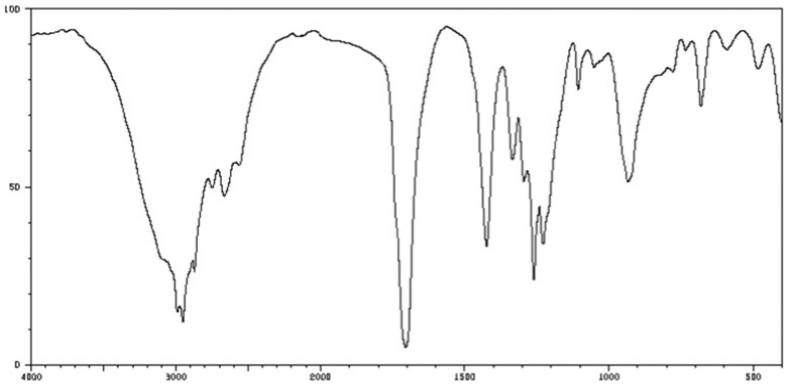
d) And for the lone pairs on oxygen **a** and oxygen **b**, which orbitals are the lone pairs in?
LPs on Oxygen **a** sp^2
LPs on Oxygen **b** sp^3

6- Assign the major peaks in the given IR spectrums and match the IR Spectrum to the compound. Assign the correct letter to the boxes below:

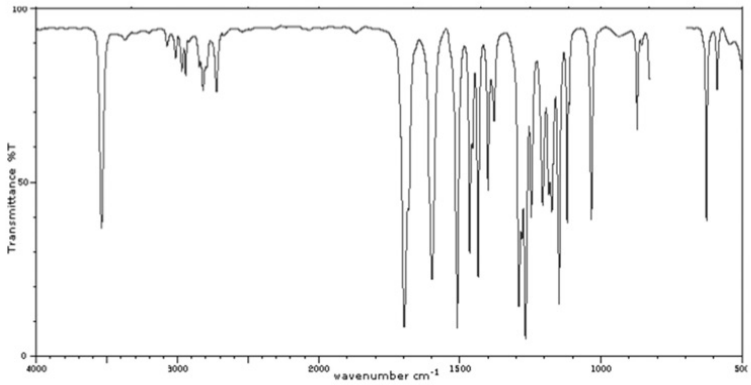
Spectrum A:

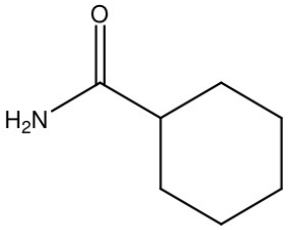


Spectrum B:

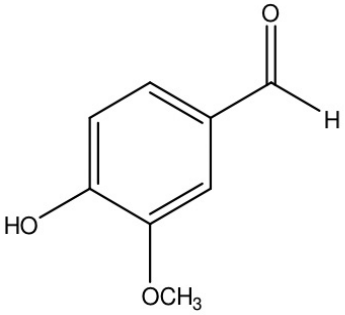


Spectrum C:

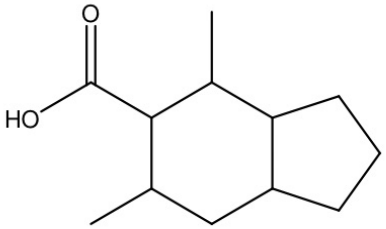




A



C



B

7- Circle true or false for the statements related to IR Spectroscopy:

a) Conjugation increases the wavenumber of a carbonyl IR peak (True / False)

b) A stronger dipole results in greater IR light absorption (True / False)

c) IR spectroscopy displays useful data about functional groups present (True / False)

8- Use the following mass spectroscopy data to determine all the possible molecular formulas. m/z: 248.0 (100.0%), 249.0 (14.5%), 250.0 (32.0%)

Cl

$[M+1] = \frac{14.5}{1.1} = 13.18$ (13 C)

IF N=0 : MAX H = 13·2+0+2 = 28

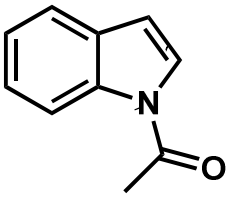
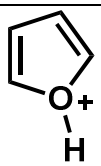
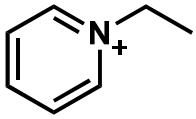
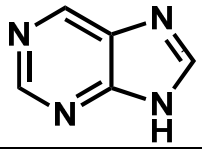
IF N=2 : MAX H = 30

IF N=4 : MAX H = 32

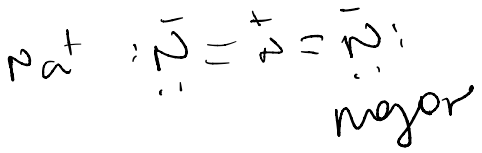
248 - (13·12) - 35 = 57 FOR O, N, H

O	N	57-O-N=H	FORMULA
1	0	57-16 = 41	
2	0	57-32 = 25	$C_{13}H_{25}O_2Cl$
3	0	57-48 = 9	$C_{13}H_9O_3Cl$
1	2	57-16-28 = 13	$C_{13}H_{13}ON_2Cl$
0	4	57-56 = 1	$C_{13}HN_4Cl$

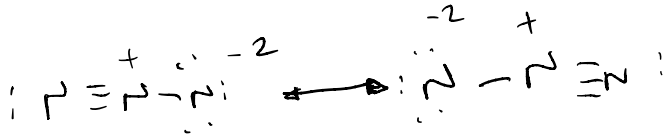
9- Decide if the molecule is aromatic and the number of pi-electrons **in the largest conjugation chain**.

Structure	Aromatic or having an aromatic part?	number of pi-electrons **in the largest conjugation chain**
	(Yes) / No $4n+2=10$	12
	(Yes) / No $4n+2=6$	6
	(Yes) / No $4n+2=6$	6
	(Yes) / No $4n+2=6$	10
	Yes / (No)	4
	(Yes) / No $4n+2=10$	10

10- a) Draw out the Lewis structure of NaN_3, clearly indicating the charges



b) Draw out the 2 resonance structures for the azide anion



c) Circle the major contributor and explain the reason

SMALLER CHARGES (BETTER CHARGE DISTRIBUTION)

d) state the noncovalent forces present

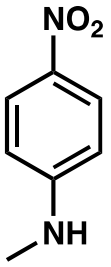
ANION - CATION

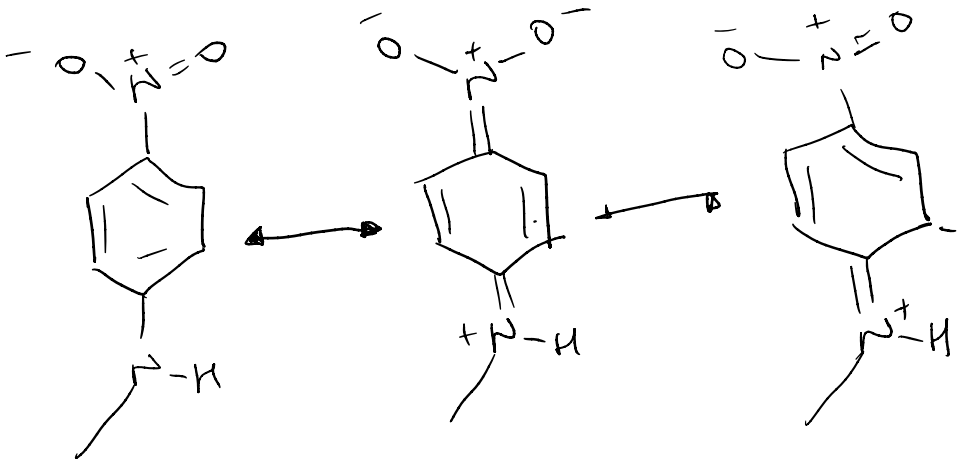
11- For N-methyl 4 -nitroaniline

a) Draw out 3 **resonance structures for this compound** (excluding structures obtained by merely shifting benzene bonds)

b) Circle the major contributor(s)

Structure:





c) Draw the resonance hybrid for N-methyl-4-nitroaniline