

OCI Dr. Greenberg

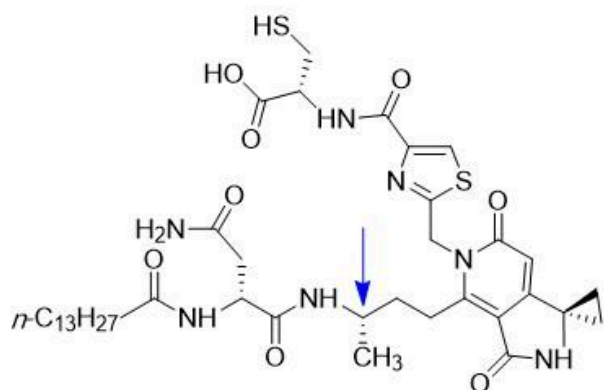
FA25 Midterm 1 Practice Exam (Blank)

MAIN GROUPS												MAIN GROUPS											
1A 1																						8A 18	
1 H 1.008	2A 2																					2 He 4.003	
3 Li 6.941	4 Be 9.012	TRANSITION METALS																				10 Ne 20.180	
11 Na 22.990	12 Mg 24.305	3B 3	4B 4	5B 5	6B 6	7B 7	8B 8	8B 9	8B 10	1B 11	2B 12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.066	17 Cl 35.453	18 Ar 39.948						
19 K 39.098	20 Ca 40.078	21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	31 Ga 69.723	32 Ge 72.61	33 As 74.992	34 Se 78.96	35 Br 79.904	36 Kr 83.80						
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc [98]	44 Ru 101.07	45 Rh 102.90	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29						
55 Cs 132.91	56 Ba 137.33	57 La* 138.91	58 Hf 178.49	59 Ta 180.95	60 W 183.84	61 Re 186.21	62 Os 190.23	63 Ir 192.22	64 Pt 195.08	65 Au 196.97	66 Hg 200.59	67 Tl 204.38	68 Pb 207.2	69 Bi 208.98	70 Po [209]	71 At [210]	72 Rn [222]						
87 Fr [223]	88 Ra [226]	89 Ac** [227]	90 Rf [261]	91 Db [262]	92 Sg [266]	93 Bh [264]	94 Hs [265]	95 Mt [268]	110	111	112		114		116		118 [293]						
* LANTHANOIDS																							
58 Ce 140.12 59 Pr 140.91 60 Nd 144.24 61 Pm [145] 62 Sm 150.36 63 Eu 151.96 64 Gd 157.25 65 Tb 158.92 66 Dy 162.50 67 Ho 164.93 68 Er 167.26 69 Tm 168.93 70 Yb 173.04 71 Lu 174.97																							
** ACTINOIDS																							
90 Th 232.04 91 Pa 321.04 92 U 238.03 93 Np [237] 94 Pu [244] 95 Am [243] 96 Cm [247] 97 Bk [247] 98 Cf [251] 99 Es [252] 100 Fm [257] 101 Md [258] 102 No [259] 103 Lr [262]																							

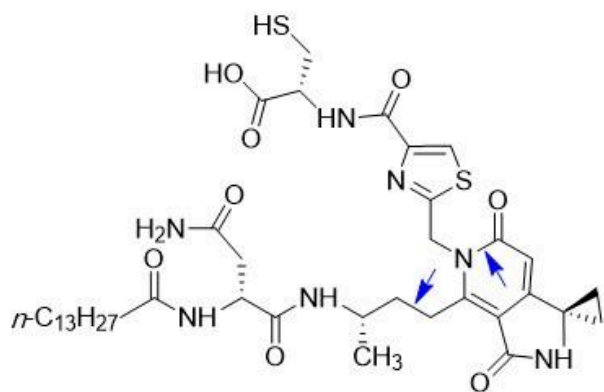
Question	Points
I	30
II	21
III	36
IV	20
V	28
VI	15
TOTAL	150

I. (30 points)

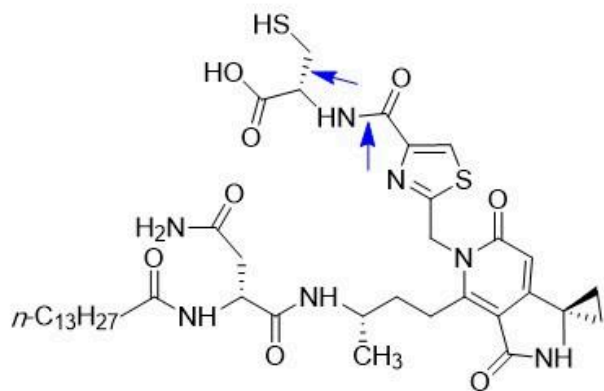
A. What is the configuration (R or S) at the carbon indicated by the arrow?



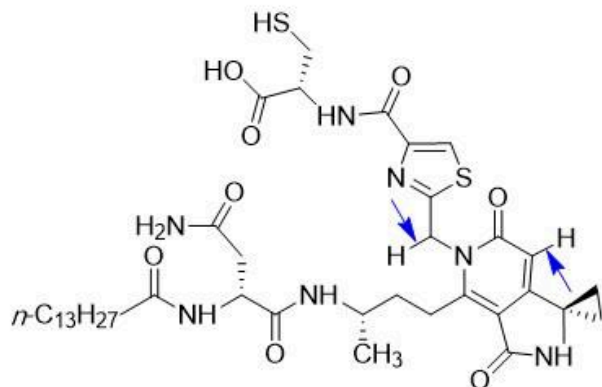
B. Which of the two bonds indicated by arrows is longer? Briefly explain your answer using fundamental principles.



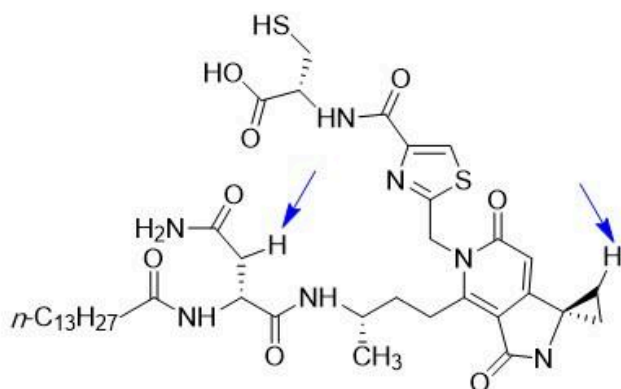
C. Which of the two bonds indicated by arrows has the greater rotational barrier? Briefly explain your answer using fundamental principles.



D. Which of the two bonds indicated by arrows is weaker? Briefly explain your answer using fundamental principles.

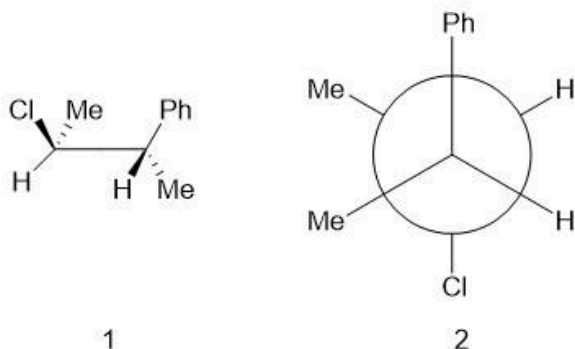


E. Which of the protons indicated by arrows is the least acidic? Briefly explain your answer using fundamental principles.

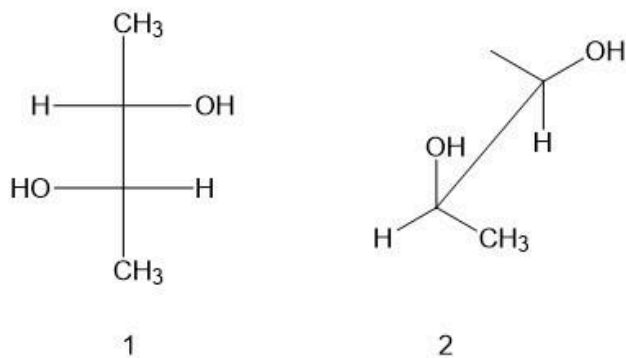


II. (21 points) State whether the following statements are true or false. Briefly explain each answer using fundamental principles, using structures when appropriate.

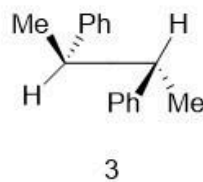
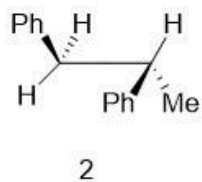
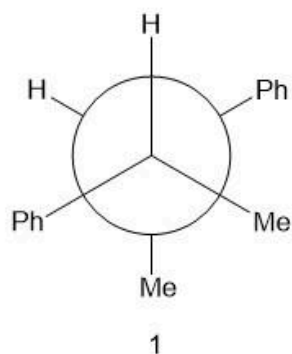
A. True or False? Molecules 1 and 2 are enantiomers.



B. True or False? Compound 1 is more soluble than 2 in the solvent heptane (C_7H_{16}).



C. True or False? The free energy of formation (ΔG) of 1 is less than that of 2 and 3. In other words, 1 is more stable than 2 and 3.

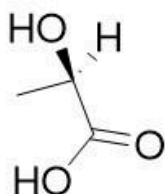
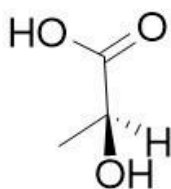


"A-Values" (kcal/mol)
 Me = 1.8
 Ph = 2.7

III. (36 points) Answer the questions regarding the molecules below.

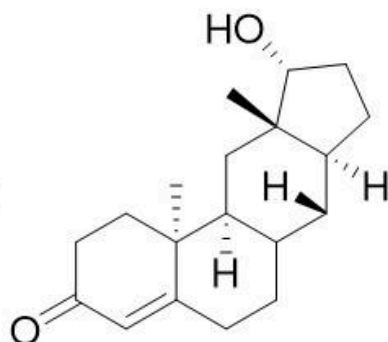
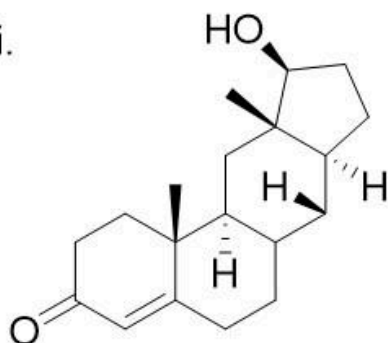
A. Circle all descriptors that correctly describe the relationship between 1 and 2.

i.



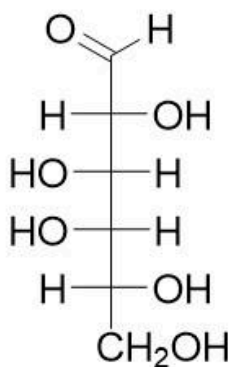
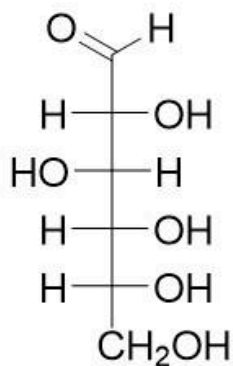
Stereoisomers
Conformational isomers
Configurational isomers
Enantiomers
Diastereomers
Structural isomers
Same molecule

ii.



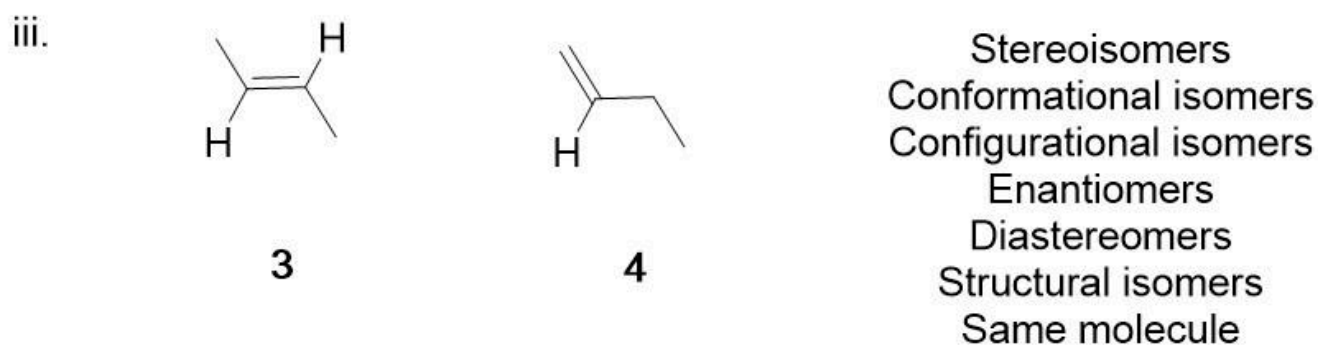
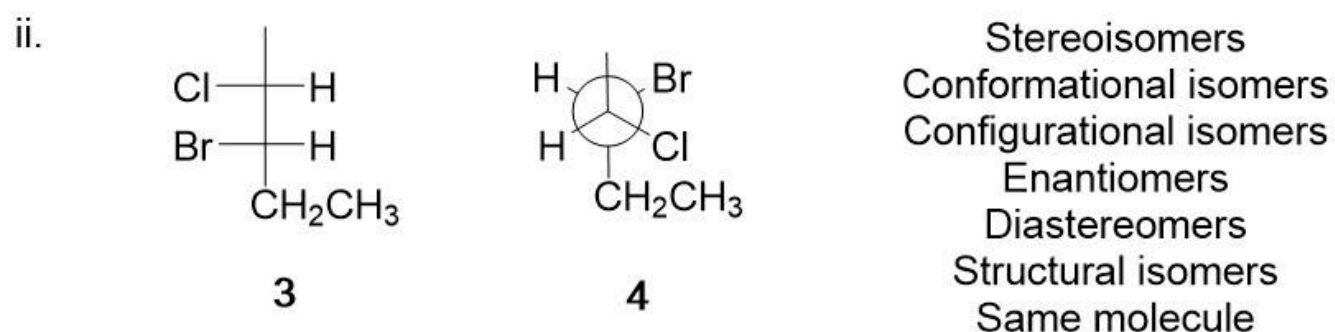
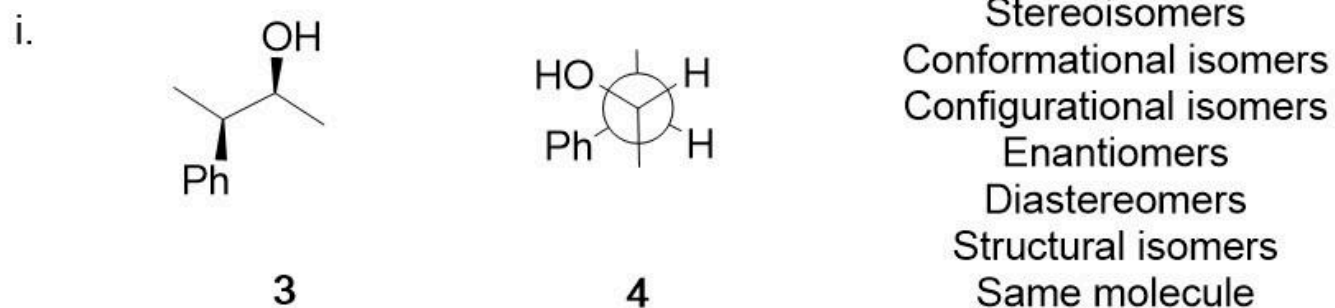
Stereoisomers
Conformational isomers
Configurational isomers
Enantiomers
Diastereomers
Structural isomers
Same molecule

iii.

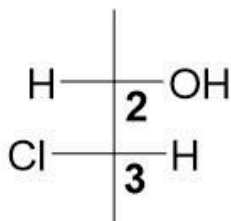


Stereoisomers
Conformational isomers
Configurational isomers
Enantiomers
Diastereomers
Structural isomers
Same molecule

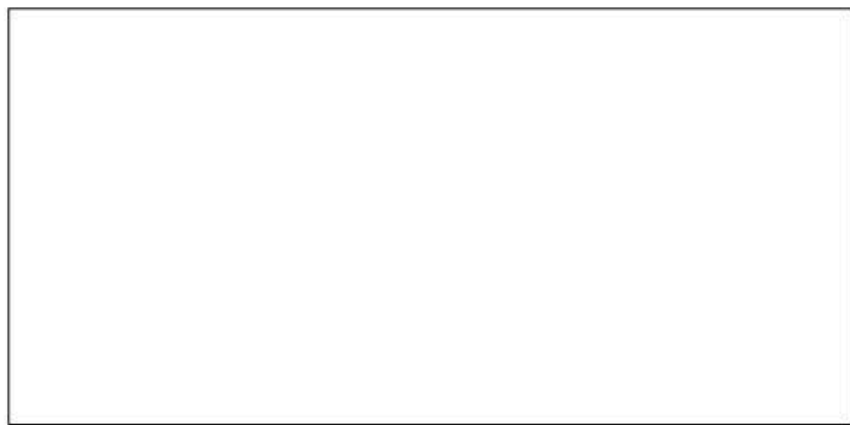
B. Circle all descriptors that correctly describe the relationship between 3 and 4.



C. Draw the Newman projection looking from C2 towards C3 in the molecule when it is in the conformation in which the methyl groups are anti-periplanar.

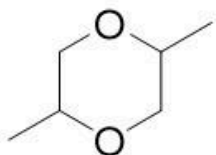


D. Draw the least stable chair conformation of (1R, 4S, 5S)-4-isopropyl-5-methoxy-3,3-dimethylcyclohexan-1-ol. Be sure to clearly indicate the absolute stereochemistry and do not draw the enantiomer.

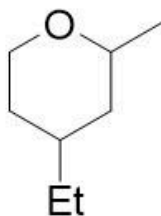


IV. (20 points) Please answer the following questions concerning the molecules below.

A. Draw the most stable chair conformation of (2R,5R)-2,5-dimethyldioxane. Be sure to clearly indicate stereochemistry.



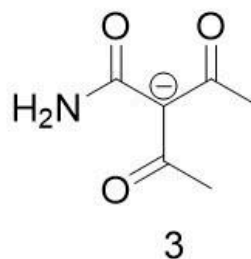
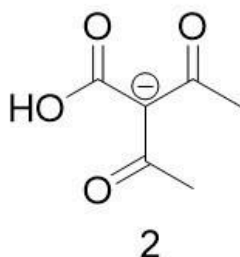
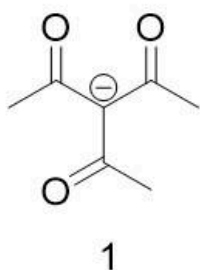
B. Draw the least stable chair conformation of (2S,4S)-4-ethyl-2-methyltetrahydropyran. Be sure to clearly indicate stereochemistry.



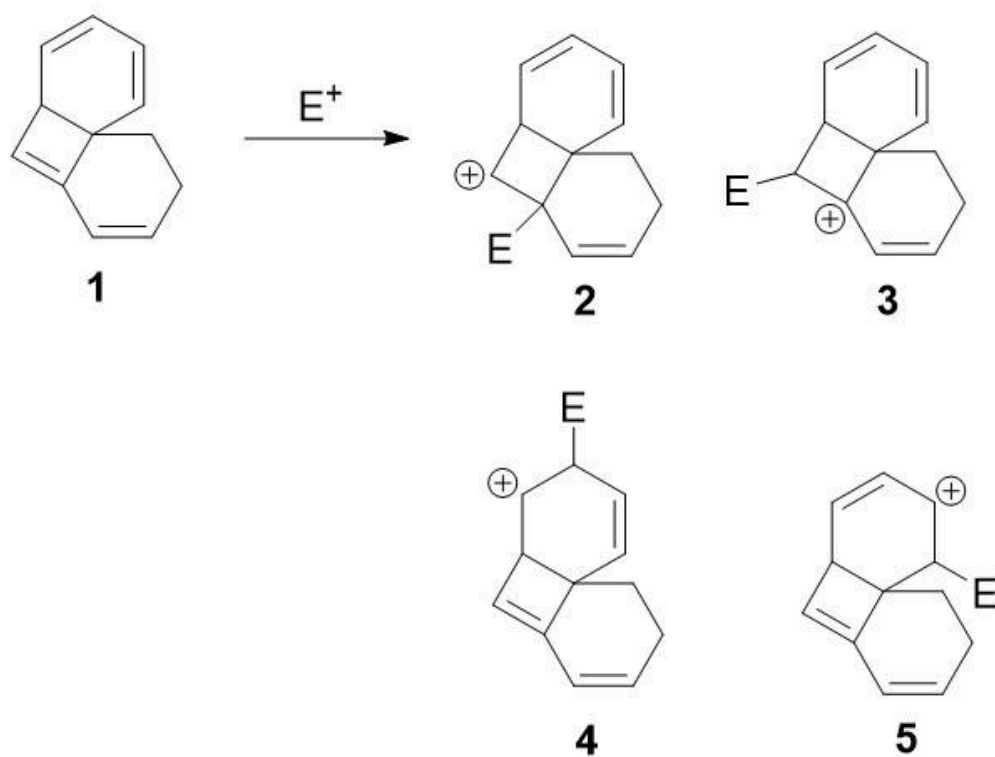
V. (28 points) Carbanions are negatively charged carbons and contain a pair of unshared electrons, which means that they are nucleophiles (Nu:). Hence, carbanions react with (form bonds to) electrophiles (E).



A. Of the 3 carbanions below, which is the most reactive with an electrophile? Be sure to briefly explain your answer using words (Hint) and/or structures.

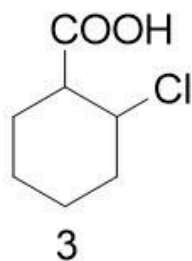
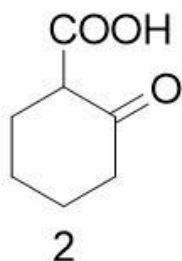
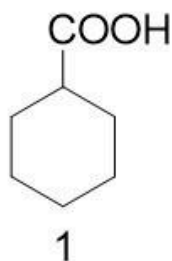


B. Which product do you expect will be formed in greatest amount when structure 1 reacts with an electrophile? Briefly explain with words or structures.



VI. (15 points) The acidity of a molecule is affected by its structure.

A. Which of the molecules is the strongest acid? Briefly explain your answer using words and/or structures. Note: the acidic proton in each molecule is the one bonded to oxygen.



B. The pK_a of an amide (1) is ~ 15 . It is $\sim 10^{20}$ times more acidic than amines. Briefly explain why using words and/or structures.

