Name:_____

CHEMISTRY 3311, Fall 1997
Professor Walba
Second Hour Exam
October 25th, 1997

scores:

1)

2)

3)

4)

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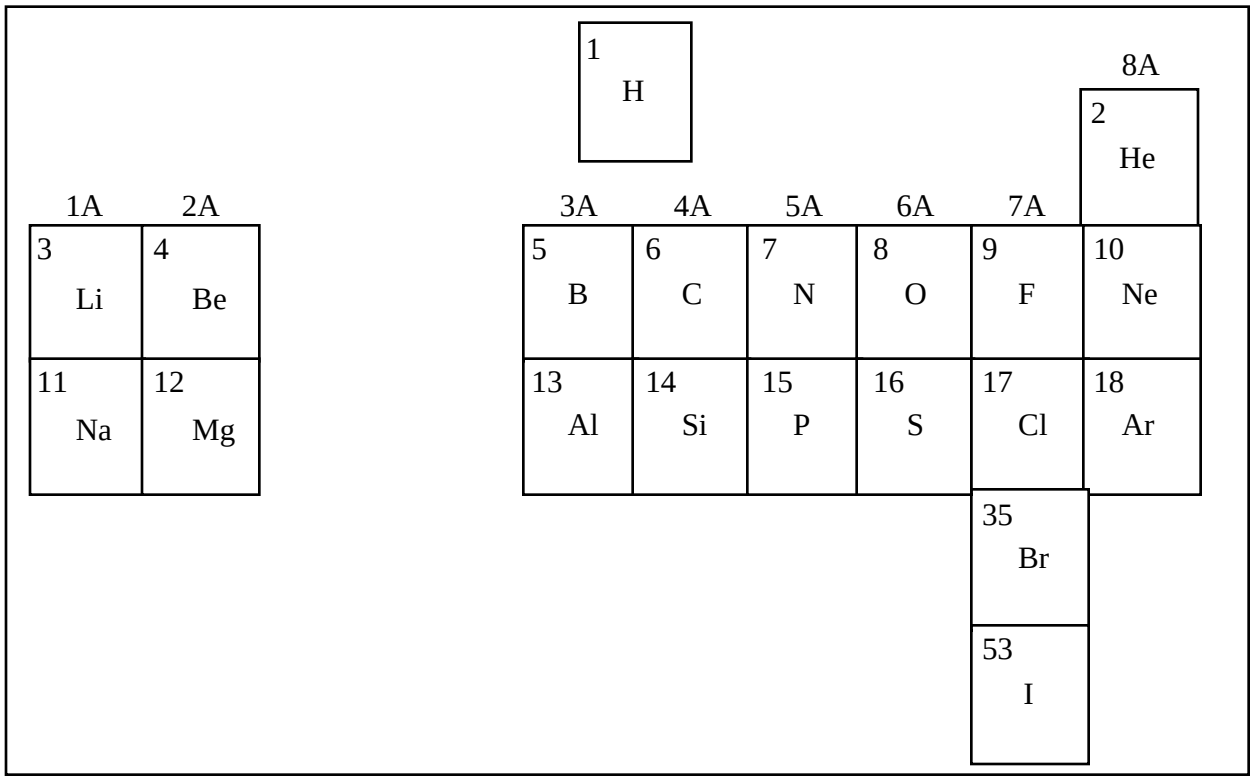
This is a closed-book "open model" exam. You may use models, but no notes or books. Please put all your answers on the test. Use the backs of the pages for scratch. There are additional scratch sheets at the end of the exam.

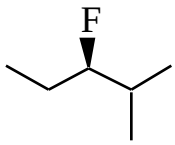
Please Read the Questions Carefully!

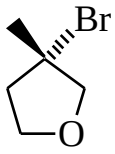
Partial Periodic Table

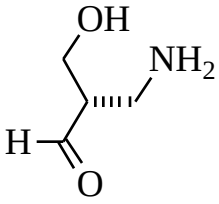


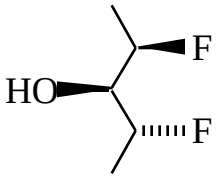
Name:_____

1) (25 pts) a) Label each tetrahedral stereogenic center in the following structures using the CIP (R or S) system. Be careful to indicate which stereocenter goes with each descriptor.

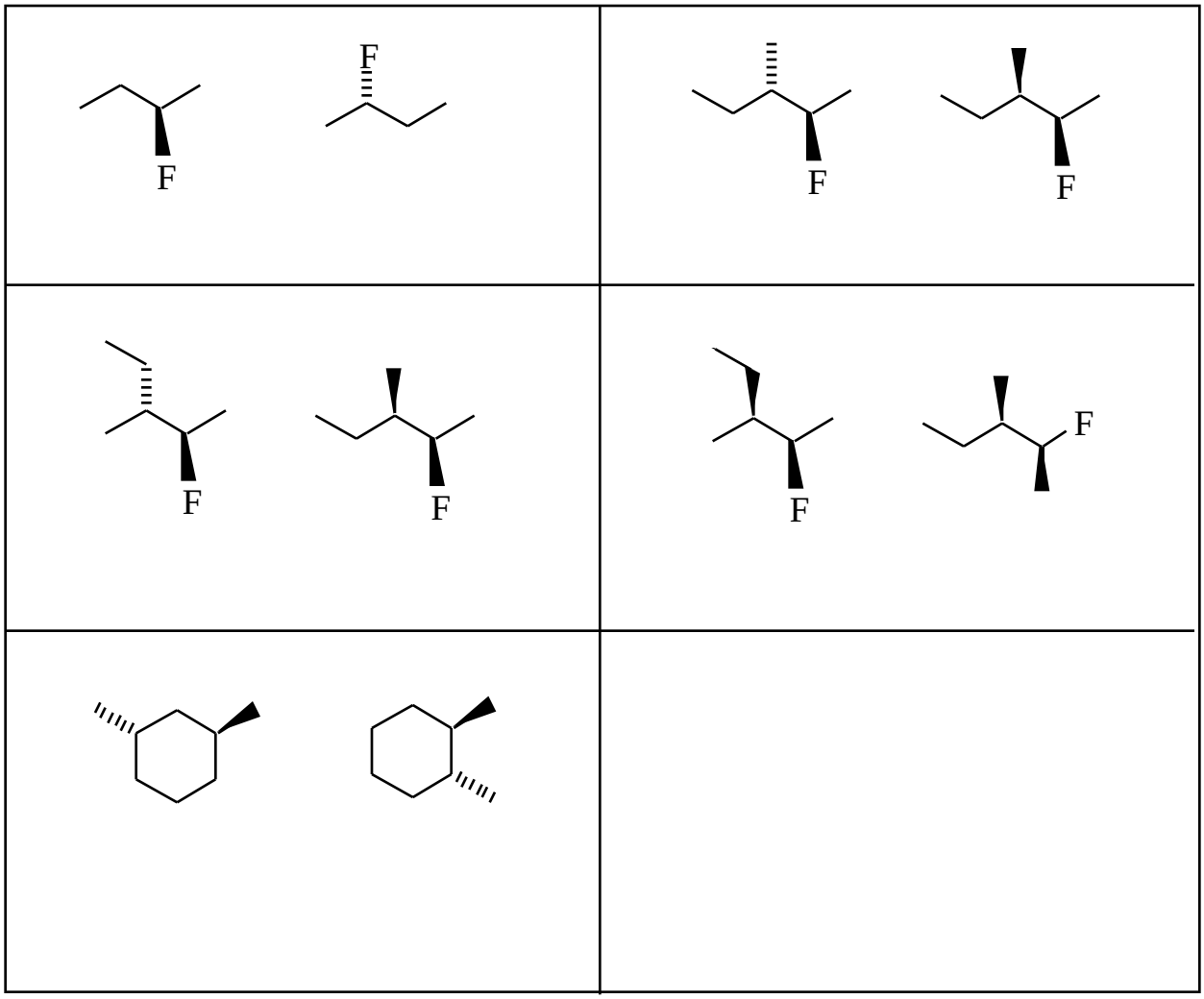








b) Label each of the following pairs of structures as homomers, conformers, enantiomers, diastereomers or structural isomers. In our class, conformers are NOT enantiomers or diastereomers. This question relates to the description of chemical compounds at room temperature on a long time scale. For example, enantiomeric structures represent molecules which, when present in a large ensemble of molecules comprising macroscopic samples of material, can be purified into isomers with equal magnitude but opposite sign of rotation of polarized light.



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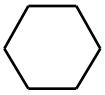
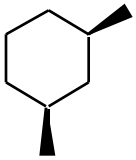
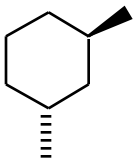
2) (25 pts) a) Carefully draw one perspective chair structure of cyclohexane, showing all the H atoms. Please draw your structure in the box.



cyclohexane

b) For the following dimethylcyclohexane isomers draw the two possible chair conformations for each isomer (that means you should have four perspective chair structures drawn, two equilibrating structures in each box). Of course you need to put the methyl groups on the structures, but please do not put in the H atoms. For each pair of conformations, circle the more stable one. If the two conformations have the same energy, label that pair "same". Using your conformational analysis, circle the more stable compound! This means one of the structures I have drawn should be circled.





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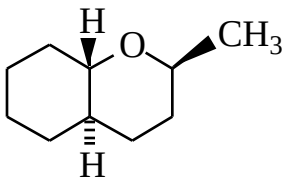
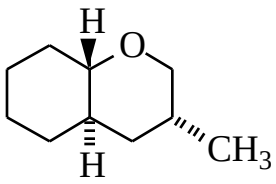
2 - continued -

c) Draw a single perspective chair structure for each of the two bicyclic compounds given below. Circle the more stable structure. HINTs: i) With respect to conformation, sp3 oxygen behaves similarly to sp3 carbon in a six-membered ring; and ii) A lone pair on oxygen is smaller than an H on carbon.





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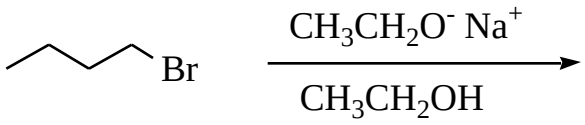
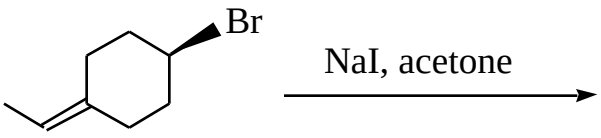
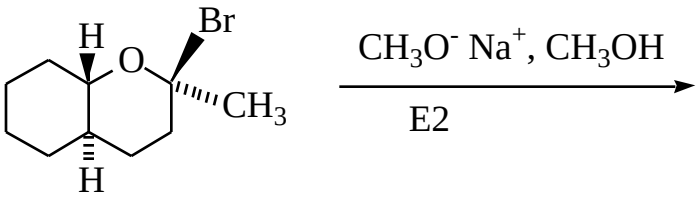
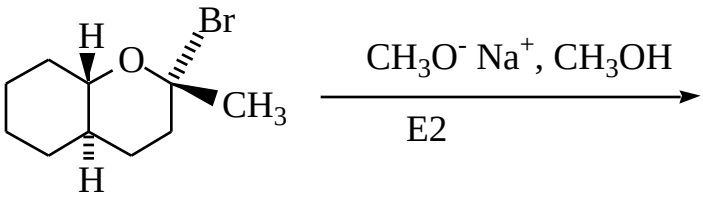
3) (25 pts) Give the single major product of each of the following reactions. If two major products are formed, give the structure of both major products. Show the stereochemistry of the product using wedges and dashes if appropriate. If a mechanism is indicated, then give the products expected from that mechanism.









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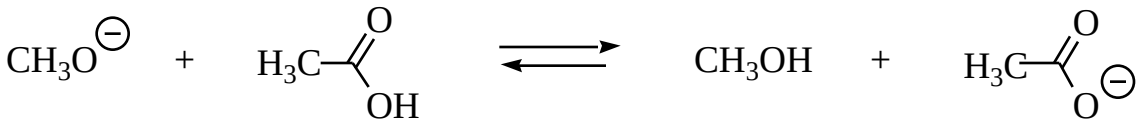
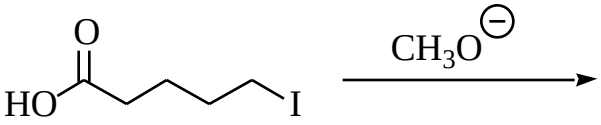
4) (25 pts) a) The following Brønsted acid/base reaction is extremely fast (much faster than any S_N2 reaction of an alkyl halide). Does the equilibrium lie on the right, or on the left?



b) Predict the product of the following reaction (the molecular formula of the product is given - be sure your structure has the right molecular formula).



$C_5H_8O_2$

c) Propose reagents for accomplishing the following transformation (more than one step is required). You can show all the steps over and under the arrow in the equation - or you can show the reactions stepwise below the equation. You can use any organic reagents (starting materials) with five carbons or less, and any inorganic reagents you need.